Science and Invention

OCTOBER

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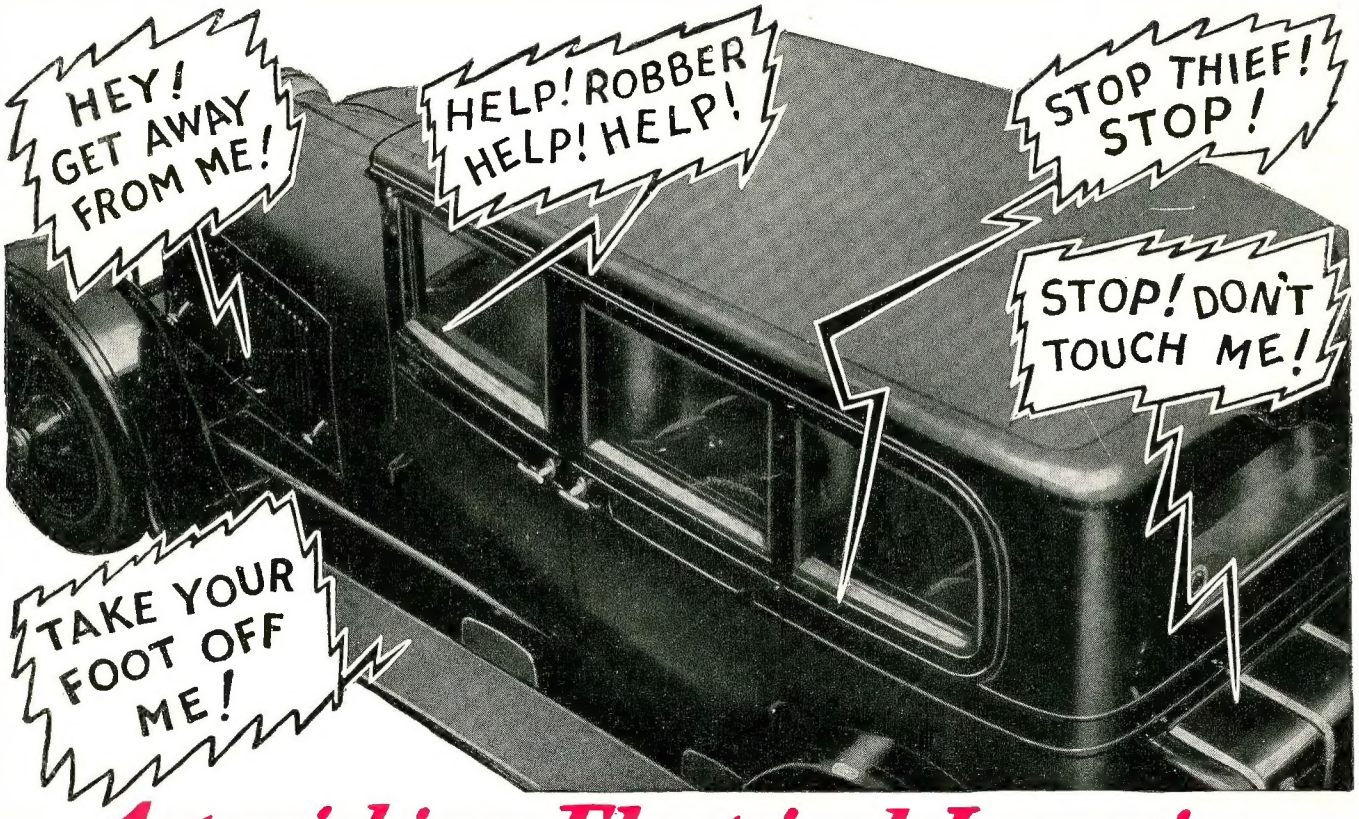


Astonishing Electrical Invention

Protects Your Car from Thieves

...Automatically!

This unquestionably is the queerest, most incredible invention since the first discoveries of radio! A magical, shouting, automatic watchman that actually is far more than human! Never sleeps, rests or gets tired! Stands guard over your entire car from spare tire to headlights and steering wheel! Endorsed by police! Approved by Motor Association! Now offered on generous 5-day free test basis! The coupon brings full details.

A Startling Uncanny Money Maker for Agents

"WHAT makes it work?" "Where on earth did you get it?" "Bet you five dollars he's got someone hiding in there!" "It simply can't be true." A running fire of comment like this breaks out whenever and wherever this new invention is exhibited. And why not? When no one ever heard of such a startling, uncanny device before! In fact few people would even dare to dream there could be such a thing! So this, men, is something really NEW, something to grip the imagination of everyone, something that sells to every autoist on sheer novelty alone. Distributors, "star" salesmen, every man who wants to double and triple his present income should note carefully the following facts.

The Secret of a Theft-Proof Car

Now in this amazing new way, every car can be protected from theft for 24 full hours a day. In the garage or parked on the street, if any thief so much as pulls at your spare tire or touches his foot to your running board—ZOWIE! A riot of noise starts instantly! And your car never shuts up till the thief leaves. And listen to this. Even if the thief is wise to what's up, you alone place the secret control button anywhere you want it around the car. The thief can't possibly find it. If he wastes time looking for it—Bingo! He's caught and on his way to jail! This astonishing invention guards your spare tire, headlights and spot-lights as well as the car itself.

A Mere Handfull

Note the tiny size of this amazing invention in the above picture. The switch, wire and sealed tube containing the "activator" is all there is to it. The entire cost is scarcely more than an ordinary radio tube! Test it. Mail the coupon today.

Installed in 10 Minutes—Costs Nothing to Operate

The inventor has asked the U. S. Government to protect his patent rights on this revolutionary discovery. Because of its uncanny powers and to distinguish it from everything else on earth this queer discovery is now called "Devil Dog."

Among its amazing features is the fact that it can be installed by anyone in 10 minutes or less. There is absolutely no cost for operation. It will last as long as the car. Fits any car from Ford to Rolls Royce without adjustment or fussing.

For introductory purposes a special 5-day test offer is now being made. If you are interested in learning about the most astonishing invention since the radio first came in, use the coupon at once. If your present income is less than $50 a week, the profit possibilities as our agent may astonish you. The coupon brings details of all offers. Mail it now.

NORTHWEST ELECTRIC CORP.
Dept. P-570 Pukwana, So. Dakota

AUTOMATIC DEVIL DOG

NORTHWEST ELECTRIC CORP.
Dept. P-570
Pukwana, So. Dakota

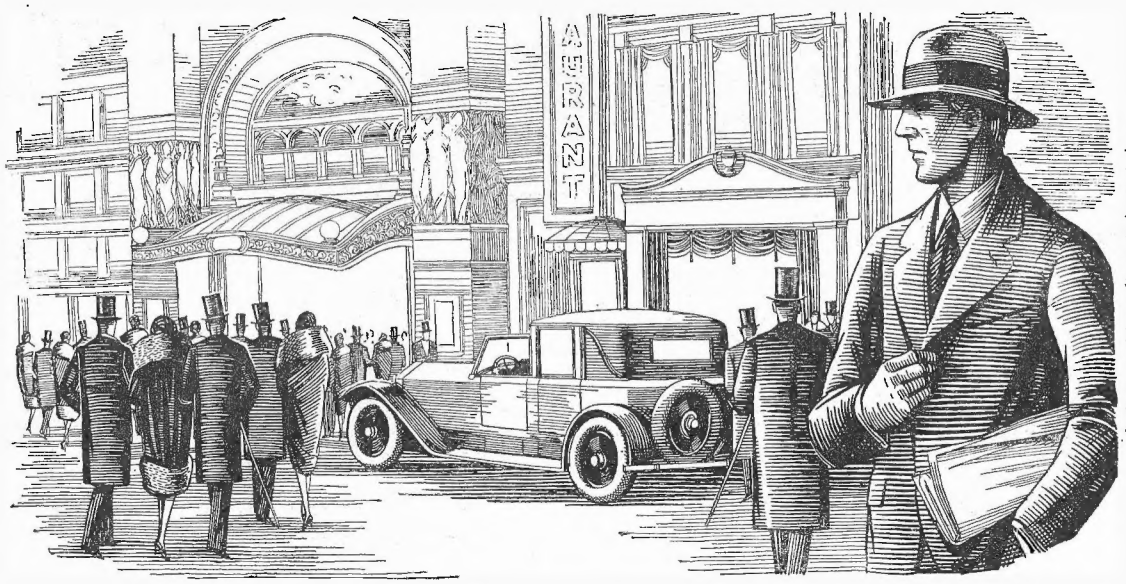
Rush details of your big 5-day test offer and big profits for agents.

Name.....

Address.....

Town..... State.....

☐ Check here if interested only in one for your own car and not in agents' money-making offer.



Always outside of things —that's where I was just twelve short months ago. I just didn't have the cash, that was all. No theatres, no parties, no good restaurants. No real enjoyment of life. I was just getting by, just existing. What a difference today! I drive my own car, have a good bank account, enjoy all the amusements I please.

I Couldn't Get the Good Things of Life

Then I Quit My Job and "Found" Myself!

HOW does a man go about making more money? If I asked myself that question once, I asked it a hundred times!

I know the answer now—you bet. I know the way good money is made, and I'm making it. Gone forever are the days of cheap shoes, cheap clothes, walking home to save carfare, pinching pennies to make my salary last from one pay-day to the next one. I own one of the finest Radio stores you ever saw, and I get almost all the Radio service and repair work in town. The other Radio dealers send their hard jobs to me, so you can see how I stand in my line.

But—it's just a year ago that I was a poorly paid clerk. I was struggling along on a starvation salary until by accident my eyes were opened and I saw just what was the matter with me. Here's the story of just how it happened.

One of the big moments of my life had come. I had just popped the fatal question, and Louise said, "Yes!"

Louise wanted to go in and tell her father about it right away, so we did. He sort of grunted when we told him the news, and asked Louise to leave us alone. And, my heart began to sink as I looked at his face.

"So you and Louise have decided to get married," he said to me when we were alone. "Well, Bill, just listen to me. I've watched you often here at the house with Louise and I think you are a pretty good, upstanding young fellow. I knew your father and mother, and you've always had a good reputation here, too. But let me ask you just one question—how much do you make?"

"Twenty-eight a week," I told him.

He didn't say a word—just wrote it down on a piece of paper.

"Have you any prospects of a better job or a good raise some time soon?" he asked.

"No, sir; I can't honestly say that I have," I admitted. "I'm looking for something better all the time, though."

"Looking, eh? How do you go about it?"

Well, that question stopped me.

How did I? I was willing to take a better job if I saw the chance all right, but I certainly had laid no plans to make such a job for myself. When he saw my confusion he grunted. "I thought so," he said. Then he held up some figures he'd been scribbling at.

"I've just been figuring out your family budget, Bill, for a salary of twenty-eight a week. I've figured it several ways, so you can take your pick of the one you like best. Here's Budget No. 1: I figure you can afford a very small unfurnished apartment, make your payments on enough plain, inexpensive furniture to fix such an apartment up, pay your electricity, gas and water bills, buy just about one modest outfit of clothes for both of you once each year, and save three dollars a week for sickness, insurance, and emergencies. But you can't eat. And you'll have to go without amusements until you can get a good, substantial raise in salary."

I began to turn red as fire.

"That budget isn't so good after all," he said, glancing at me; "maybe Budget No. 2 will sound better——"

"That's enough, Mr. Sullivan," I said. "Have a heart. I can see things pretty clearly now; things I was kidding myself about before. Let me go home and think this over." And home I went, my mind in a whirl.

At home I turned the problem over and over in my mind. I'd popped the question at Louise on impulse without thinking it out. Everything Mr. Sullivan had said was gospel truth. I couldn't see anything to do, any way to turn. But I had to have more money.

I began to thumb the pages of a magazine which lay on the table beside me. Suddenly an advertisement seemed almost to leap out at my eyes, an advertisement telling of big opportunities for trained men to succeed in the great new Radio field. With the advertisement was a coupon offering a big free book full of information. I sent the coupon in, and in a few days received a handsome 64-page book, printed in two colors, telling all about the opportunities in the Radio field and how a man can prepare quickly and easily at home to take advantage of these opportunities. I read the book carefully, and when I finished it I made my decision.

What's happened in the twelve months since that day seems almost like a dream to me now. For ten of those twelve months I've had a Radio business of my own! At first, of course, I started it as a little proposition on the side, under the guidance of the National Radio Institute, the institution that gave me my Radio training. It wasn't long before I was getting so much to do in the Radio line that I quit my measly little clerical job and devoted my full time to my Radio business.

Since that time I've gone right on up, always under the watchful guidance of my friends at the National Radio Institute. They would have given me just as much help, too, if I had wanted to follow some other line of Radio besides building my own retail business, such as broadcasting, manufacturing, experimenting, sea operating, or any one of the score of lines they prepare you for. And to think that until that day I sent for their eye-opening book, I'd been wailing, "I never had a chance!"

Now I'm making real money. Louise and I have been married six months, and there wasn't any kidding about budgets by Mr. Sullivan when we stepped off, either. I'll bet that today I make more money than the old boy himself.

Here's a real tip. You may not be as bad off as I was. But, think it over—are you satisfied? Are you making enough money, at work that you like? Would you sign a contract to stay where you are now for the next ten years, making the same money? If not, you'd better be doing something about it instead of drifting.

This new Radio game is a live-wire field of golden rewards. The work, in any of the 20 different lines of Radio, is fascinating, absorbing, well paid. The National Radio Institute—oldest and largest Radio home-study school in the world—will train you inexpensively in your own home to know Radio from A to Z and to increase your earnings in the Radio field.

Take another tip—no matter what your plans are, no matter how much or how little you know about Radio—clip the coupon below and look their free book over. It is filled with interesting facts, figures, and photos, and the information it will give you is worth a few minutes of anybody's time. You will place yourself under no obligation—the book is free and is gladly sent to anyone who wants to know about Radio. Just address J. E. Smith, President, National Radio Institute. Dept. OLSS, Washington, D. C.

J. E. SMITH, President,
National Radio Institute,
Dept. OLSS, Washington, D. C.

Dear Mr. Smith:

Please send me your 64-page free book, printed in two colors, giving all information about the opportunities in Radio and how I can learn quickly and easily at home to take advantage of them. I understand this request places me under no obligation, and that no salesmen will call on me.

Name .....

Address .....

Town .....State .....

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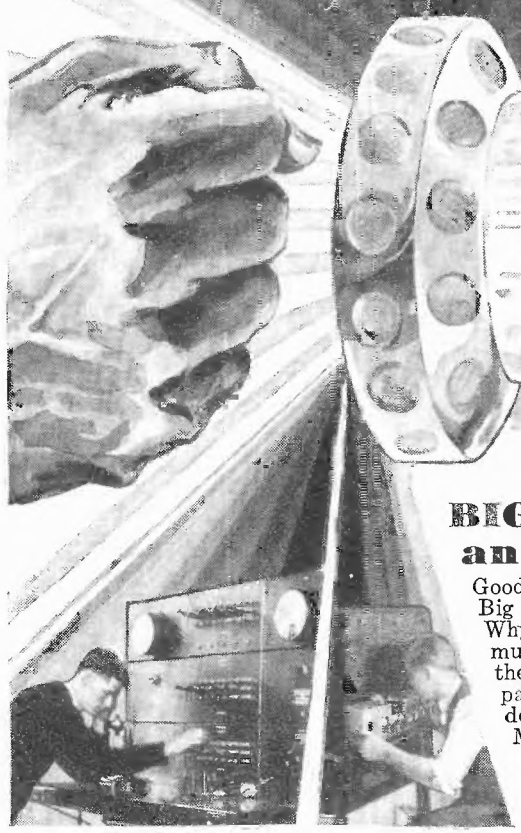
OPPORTUNITY
IS KNOCKING AT YOUR DOOR



RIGHT NOW from this GREAT FIELD of RADIO TELEVISION TALKING PICTURES

BIG MONEY STEADY JOBS OFFERED and the Definite Way to Get Them

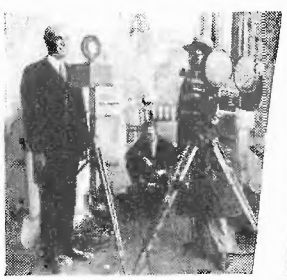
Good Jobs at Good Pay! Steady, Interesting Work! Fine Profits for your Spare Hours! Big Money as Your Own Boss! That's the Opportunity for you in Radio right Now! Why? Because the great, fast-growing Radio industry has reached the stage where it must have many more trained men. Most of those now employed are untrained—they just "picked up" what they know about radio, and even many of them get good pay. But the *Big Pay Steady* jobs go to the *Trained Man*, and R.T.I. offers you the definite way to prepare for them. R.T.I. training is endorsed by Leading Radio Men and Radio Trade Associations.

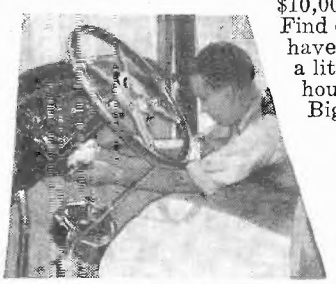
R. T. I. TRAINS YOU AT HOME FOR THE BETTER PAID RADIO JOBS

Do you want to get into some branch of Radio where trained men can easily make $40 to $50 weekly—where some earn $75 to $100 per week—where trained experienced men are selected for executive positions paying up to $5,000 and $10,000 yearly and more? Then send for the R.T.I. Radio Opportunity Book. Find out how R.T.I. trains you at home for this well-paid work—you don't have to give up your present job—you learn quickly and thoroughly—just a little time needed at home—earn an extra $10 to $20 per week in spare hours while learning—Then step into radio and go steadily on up to the Big Money. No experience needed to start—R. T. I. starts you right.

BROADCASTING
Stations demand better trained men

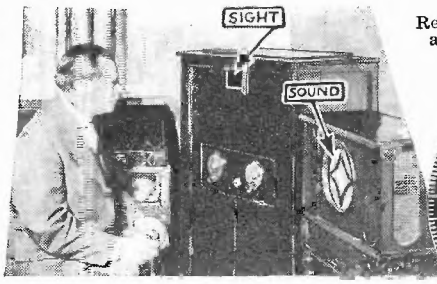
SERVICE
Where R. T. I. training brings quick money.





TALKIES
Studio and theatre apparatus requires trained men.

AUTO-RADIO
Great field for men with R. T. I. training.



AVIATION
Trained radio men needed more and more.

TELEVISION
Great new branch of radio soon to call for many trained men.

LEARN TELEVISION— and Talking Pictures, Too

Be prepared for Television! Learn Talking Picture Apparatus installation, adjustment, etc.. Both of these great branches of Radio are included in the R. T. I. practical training.

LEARN FROM LEADERS

Why does the radio industry want men trained the R. T. I. way? Because you learn under experts—leading men in different branches of Radio—well known specialists of high standing.

FREE OPPORTUNITY BOOK

Remember, you need no experience to start in Radio—R. T. I. starts you right—and helps you on to success. The big R. T. I. Radio Opportunity book explains everything. If you are interested, send for it now. Don't wait.

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R. T. I. Home Training includes all these and the other branches of Radio. You learn under F. H. Schnell, "The Ace of Radio," and the R. T. I. Advisory Board of prominent radio men.

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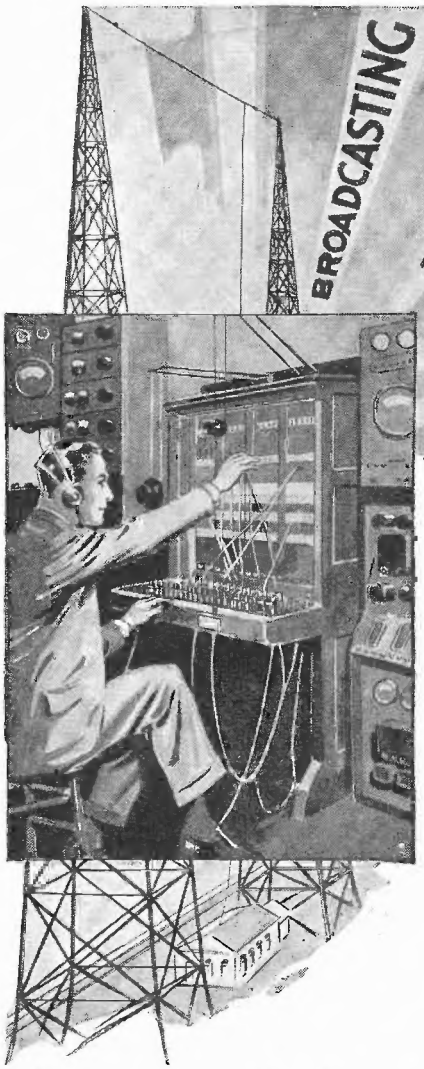
R. T. I. R. T. I. TRAINS YOU AT HOME FOR A GOOD JOB OR A PROFITABLE PART TIME OR FULL TIME BUSINESS OF YOUR OWN

Liners of Our Inland Seas

The passenger vessels of the Great Lakes grow increasingly popular as a means of transport among the many points along their shores or easily reachable from Great Lakes ports. It is startling to realize that the area of the Lakes is no less than 94,100 square miles, that more tonnage passes through the Detroit River—connecting the Upper and Lower Lakes—than through the Suez Canal, and that the eight states bordering the Great Lakes chain contain more than a third of the population of the entire country . . . The photograph shows a passenger steamer preparing for its daily trip up Lake Michigan from Chicago. The vessel is evidently a converted "whaleback" of the traditional Great Lakes type.



WIN FAME and FORTUNE in RADIO!

Don't spend your life slaving away in some dull, hopeless job! Don't be satisfied to work for a mere $20 or $30 a week. Let me show you how to make real money in Radio—the fastest-growing, biggest money-making game on earth!

THOUSANDS OF JOBS ARE OPEN
Paying $60, $70 and on up to $200 a Week

Jobs as Designer, Inspector and Tester, paying $3,000 to $10,000 a year—as Radio Salesman and in Service and Installation Work, at $45 to $100 a week—as Operator or Manager of a Broadcasting Station, at $1,800 to $5,000 a year—as Wireless Operator on a Ship or Airplane, as a Talking Picture or Sound Expert—THOUSANDS of JOBS Paying $60, $70 and on up to $200 a WEEK!

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You learn ALL branches of Radio at Coyne—**in 8 short, pleasant weeks**—NOT BY CORRESPONDENCE, but by actual work on actual Radio, Television and Sound equipment. We don't waste time on useless theory. We give you just the **practical training you will need—in 8 weeks' time.**

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Coyne is NOT a Correspondence School. We don't teach you from books or lessons. We train you on the greatest outlay of Radio, Television and Sound equipment in any school—on scores of modern Radio Receivers, huge Broadcasting equipment, the very latest JENKINS Television apparatus, Talking Picture and Sound Reproduction equipment, Code Practice equipment, etc. You don't need advanced education or previous experience. We give you—**right here in the Coyne Shops**—all the actual practice and experience you'll need.

TELEVISION
Is on the Way!

And now Television is on the way! Soon there'll be a demand for THOUSANDS of TELEVISION EXPERTS! The man who learns Television NOW can make a FORTUNE in this great new field. Get in on the ground-floor of this amazing new Radio development! Learn Television at COYNE on the very latest JENKINS Television equipment.

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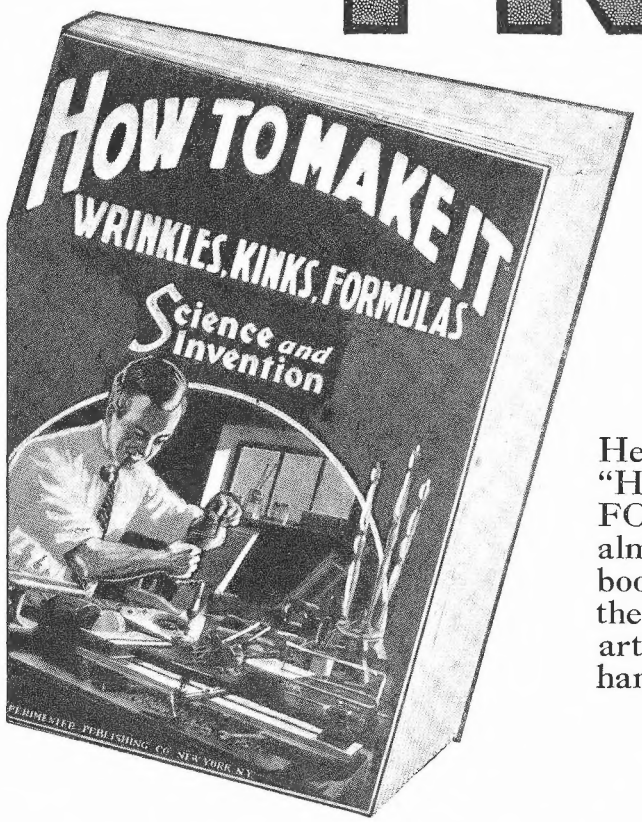
HOW-TO-MAKE-IT FREE



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Here's just the book you've been waiting for. "HOW TO MAKE IT—WRINKLES, KINKS, FORMULAS"—the complete all-around guide for almost all kinds of repairing and construction. A boon to every red-blooded man who has ever felt the urge to grip good tools and see useful finished articles take shape as the combined result of skillful hands and brain!

HERE are new thrills awaiting you—the thrills that come from making and doing things you can take pride in! Here, also, is real recreation and profit!

Breakfast Nooks — Fireplaces — Cedar Chests — Modernistic Sideboards — Blow Torches — Auto Accessories — Decorative Lighting Fixtures — Garden Fountains — Wood Lathes . . . whether it's carpentry, plumbing, masonry, electricity, "HOW TO MAKE IT" will tell you what to make and do—and how!

Hundreds of things for your car, for making your home more beautiful and comfortable, for broadening the facilities and usefulness of your own work shop!

Whether it's repairing or working in metals, concrete, woods, stains, paints, piping, or what have you—this handy book, the work of our expert mechanics and engineers, tells you exactly how by means of simple English, and scores of clear pictures, diagrams and plans.

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BUT—we have arranged to ship you this useful book, postpaid, ABSOLUTELY FREE OF CHARGE! And at the same time we will enter your subscription to SCIENCE & INVENTION for six full months (regular value $1.50), for only $1.00. *But don't delay!* To get the book FREE and two big issues of SCIENCE & INVENTION virtually WITHOUT COST, mail the coupon while we still have books on hand!

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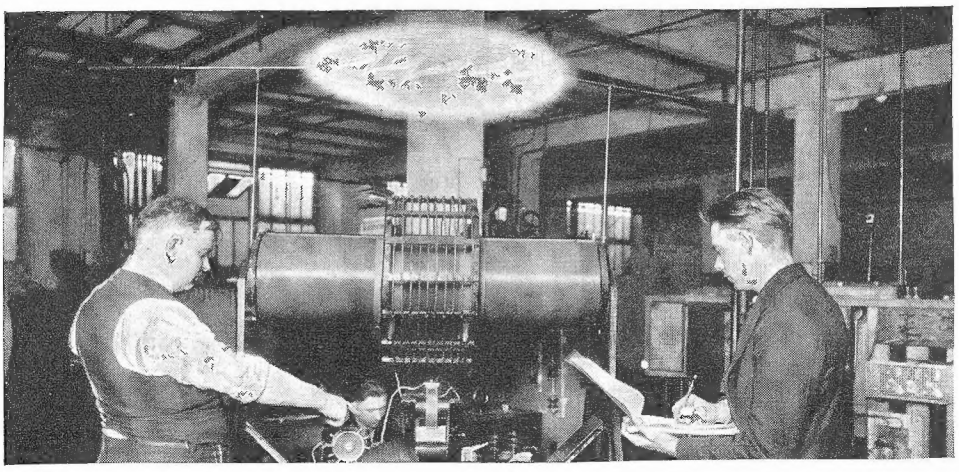

500,000 VOLTS

"Artificial lightning" being developed in COYNE school. Spark of 500,000 volts is shown jumping 30 inches. This gigantic Tesla coil is the same as that used by Steinmetz, absolutely harmless because of high frequency.

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Anyone who can see and understand the English language can master Electricity in 90 days. I teach you with the most complete outlay of electrical apparatus ever assembled in any school—30-foot control board—2-story transmitting stations—skeleton houses, huge motors of all kinds—dynamos—sub-stations—automobiles—switchboards. **In one department we generate enough electricity to supply a small city!**

No Books--No Lessons--No Classes

ENTER ANYTIME. Experts teach you without books or classes. They guide you every step of the way with individual attention. You do the actual work on real full-size machinery in full operation. Take motors for instance. Instead of learning from books and charts—you actually build motors. You can't help but know all about them. Anyone can learn this fascinating way.

No Experience Necessary

That's how my methods make men master electricity in 12 wonderful weeks. You don't need experience—Coyne training starts from the very beginning. You don't need advanced education—you learn by doing. Age is no handicap—Coyne students range from 16 to 40.

TRIPLE YOUR EARNING POWER

I don't need to tell you about the opportunities in Electricity. They are too many and too amazing to mention. Ordinary jobs run from *$50—$75—$150* a week. And Coyne training leads to the biggest positions.

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Speculate or Invest?

By Alfred M. Caddell
Financial Editor

A SHORT time ago a gentleman from South Dakota made inquiry: How can I get started in this finance business? What should I buy—stocks or bonds? Should I buy stocks outright or only in part—that is, on a margin?

There is a lot of seriousness in these questions and a little thought may easily mean the difference between loss of capital or lay the foundation for real success.

Obviously, the first necessity is a bank account upon which from 4 to 4½ per cent interest may be obtained with safety. If a person's funds exceed $1000 or $2000 or any other conservative sum that may be regarded as emergency money, the chances are that he or she will want to invest in a security yielding more revenue. As good a system to follow as any is to invest this surplus in real estate bonds issued by a reliable mortgage house. On these bonds from 5½ to 6 per cent may be obtained with safety. Generally, these bonds are guaranteed as to principal and interest, thus entailing no risk to the investor. If the person is naturally of a conservative nature, he may stick to such securities and get his 6 per cent annually. There are thousands upon thousands of investors who do not seek further income, remaining satisfied that their dollars shall bring forth six children every year.

But there are also thousands upon thousands of people who want their dollars to be more prolific. No one ever got rich on 6 per cent, they will argue, unless of course a lot of capital was available. Then, again, in the very nature of things no two people think alike and, consequently, we have all kinds of "investors," ranging from the plunger who plays a hunch with everything he has, to the conservative bond holder.

For the plunger, or sheer gambler, no one in the world can do much. But for the fellow who is sound in the head the next step generally runs from bonds to preferred stock of a company which has a good earning and dividend record. As high as 8 per cent may easily be obtained on a preferred stock of a good company. Such stock is often of short term duration, for the moment a company gets completely over the top there is no need to pay such interest, sufficient money for expansion being readily obtainable by the issuance of more common stock.

Preferred stock is, of course, not supposed to be as good security as a bond, the latter representing a mortgage on some enterprise which generally has something tangible in property behind it. All that preferred means is preference of dividends, which may be cumulative or not as stated on the stock certificates. Generally, however, such security yields no more than the stated per cent and that of course puts an effective brake upon an enhancement in its value. But preferred stock is a good stepping stone in the field of finance, and, if properly selected, offers a fairly good return on the money invested, although this type of security should by no means be considered entirely safe.

Next we come to common stock. A better name for this type of security would probably be equity stock. That is, a common stockholder is a partner in the enterprise in which he has invested and he stands to gain or lose his capital according to the success of the enterprise. And picking a common stock is something not altogether governed by cold analysis or intelligence. How many people, for instance, put their money into some automobile or radio companies, only to be left holding their stock certificates! And these companies undoubtedly showed remarkable promise.

The really safe way to get into common stocks is to pick the tried-and-proven, true ones first—those which have regularly paid dividends over a period of years and for which there still looks to be an ever-broadening future. A good stock that comes to mind is that of the American Telephone & Telegraph Company, which as this is being written has sold many millions of dollars of its stock to its own stockholders, to whom it offered valuable rights, or in other words, a discount. These rights, or discounts, are extremely valuable in themselves, and there seems to be no end in sight to the expansion of this company. It has paid 9 per cent regularly for years, its bonds carry the convertion privilege, and, counting rights, money placed behind this security may be said to be well placed.

Logically, the person most able by experience and capital to invest in new enterprises is the man who has come up the ladder of finance and knows one security from another and something of its worth. All too frequently, however, it is his brother at the opposite end of the ladder who does the plunging, and due to this a lot of extreme bitterness has grown up around security investments. If one would be honest with himself, however, he should rightfully kick himself instead of trying to work up an alibi. Investing is a science and it must be learned by him who wishes to attain success in that science. But it is a science that, if properly learned, should yield most handsome dividends.

Questions and Answers

Conducted by Alfred M. Caddell

Information on securities will be furnished readers of "Science and Invention" free of charge by mail and through these columns. A 2-cent stamped, self-addressed envelope should be included in your letter. Address your inquiries to the Financial Editor, SCIENCE AND INVENTION, 381 Fourth Avenue, New York City.

Question—Please tell me what you can about the Kolster Radio Corporation. I am a stockholder (at a high price) and now the stock is down to 4. L. U. F., Muskegon, Michigan.

Answer—Kolster was thrown into the hands of a receiver some months ago. Recently an offer was made by a financial house to raise more money for this company and at this writing the offer is still before the receivers for their decision. It is felt that they will accept some sort of favorable reorganization plan and that the company will obtain a new leasehold. What it may do in the future is of course entirely problematical. Kolster is reputed to be the owner of valuable patent rights.

Question—I own some General Motors at 78, hence the present market price shows me a very considerable loss. Would you sell? H. J. Y., Chattanooga, Tennessee.

Answer—No, I wouldn't sell General Motors. I firmly believe this stock will come back to better levels. It may be some time before it reaches 78 but in the meantime you are getting your dividends and if you sold now and took a loss you may put your money into a less stable enterprise. During the depressions the better the stock the safer is one's money, notwithstanding depreciation in price. General Motors has too many assets and sources of earning power to remain long affected by the slump unless, of course, demand in all its lines becomes further reduced. If I were you I would continue to take a chance on General Motors.

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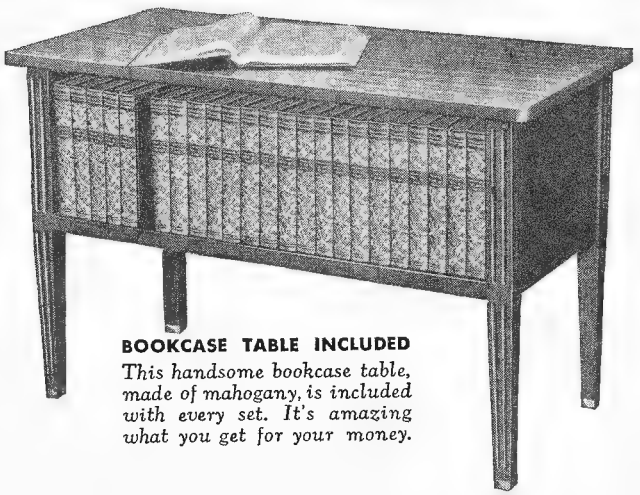

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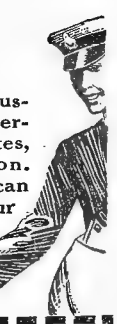

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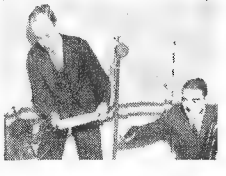
The way I see it—

By Murray Godwin

Chartless Flight

GLENN CURTISS has taken off on his last long flight over the most-traveled route in the universe, and the least-known—a flight into a region where everyone is a pioneer, and from which the first to fly there thus far has not returned. . . . Glenn Curtiss was not the first to fly in the more familiar world where our senses and their mechanical extensions serve to guide us on our aerial ventures, but certainly he was the man who did most to make flying, in the heavier-than-air sense (which really is the logical sense), seem a method of transportation rather than a precarious feat. . . . I remember seeing some very "rainy" motion pictures, years ago, of the Wright trials at Fort Myers, and was impressed by the awkward apparatus and the labor needed to get a plane into the air, as well as by the marvelous fact that it was possible actually to fly. It was only some time afterward, when I saw Pilot Willard, one of the Curtiss "early birds," reverse his cap and drive his rubber-tired biplane irresistibly up an invisible incline, that I realized in a degree the coming commonplace character of flight. . . . Later on I was fortunate enough to be one of a crowd that watched the giant Cal Rogers land in a twin-propped Baby Wright—a plane still carrying rudimentary Wright runners but equipped also with Curtiss wheels—in the course of his hard trek to the Coast, and after a short halt thresh into the air again, missing a haystack by inches, it seemed to me. And still later I caught my breath when Bud Mars, riding about the wheeziest, junkiest Curtiss barnstormer that ever got off the grass, landed in the narrow confines of a racetrack and groundlooped into the fence, after a short, groggy turn at an altitude of a few yards. . . In the main it was by all odds Glenn Curtiss and the Curtiss biplane that familiarized the American people with heavier-than-air flight and imparted to that form of flight a stability and practicability which proved invaluable. It was a job well done.

Cornerstone Broadcast



TWO forces strive for the mastery, says Dr. Walter Damrosch, in the American home. One of these is a disrupting force, the automobile; the other is a concentrating force, the radio. By means of the latter the home as it once was will be reintegrated, despite the disintegrating influence of the former, and will re-establish itself around the ideal of music in the home—"the very cornerstone of our civilization". . . . The gap in this conception of things, as I see it, extends away down to the question of whether there is any basic need for a home in the make-up of the so-called human race. One of our best-established proverbs says that a rolling stone gathers no moss, I know, but a random survey of history shows that this idea is more than a little shaky. Every country in the world today is ruled by people who were once continually on the move. The whole of Europe was conquered by roving herdsmen and seafarers. America was brought to nationhood by folks who wouldn't stay put. Among the more barbaric peoples, the only ones who are left unmolested are those who never park for more than a few weeks in one spot—Mongols and Bedouins, for example. While the peoples who never have left home are earning other peoples' bread for them—the peasant Indians of Bolivia and Peru are among these. . . . It seems to me that our own emphasis on home is the result of circumstances, and circumstances notoriously are subject to change. To select anything which depends on circumstances and insist that it is one of the eternal verities—this is to put oneself out of joint with the universal heave and shift that distinguishes life from death. The American people were relatively inert yesterday; today they are relatively on the go. To say that the radio will make them hug the hearth again and engage in family musicfests is to talk nonsense. Tomorrow a large proportion of motor nomads will take their favorite programs on the road with them: already several brands of cars are especially equipped for radio on the run. . . . As for music in the home being a cornerstone of anything, I don't think it ever was. The 'eighties and 'nineties saw the heyday of the music-in-the-home theory: excessively sedate young women learned to putter on the piano, mainly as a means to social distinction. In the nineteen-hundreds the social worth of this accomplishment had worn so thin that it took threats to keep most of the budding Beethovenesses in line; and at that, the greater number of them achieved nothing more than the ability to feel their way feebly through *Hearts and Flowers*, *Cheyenne*, and *Red Wing*. After 1910, the life of the party was the bozo who could improvise ragtime, and the War brought on the reign of jazz, and the advent of the itinerant saxophone wrangler. . . . One laughable phase of the matter is that the younger generation of today carts its musical weapons with it as indispensable equipment, wherever it goes, whereas the generation of the music-in-the-home era restored to music only as a means to distinction and an escape from boredom. In other words, the present generation is perhaps the strongest for music of any, and also the strongest for the nomad life. Nor does this love of gallivanting depend especially on the motor car: each summer Sunday one can see hundreds of youngsters hoofing it afield with their string and brass equipment slung from their sturdy shoulders, all set to treat nature to a real session of wild melody at the first stop. I have a hunch that these wandering minstrels regard Dr. Damrosch's "cornerstone of civilization" as rather a millstone, and that any attempt to hang it around their necks would send them stampeding into the hills.

Reading By Machine

MY FRIEND Bob Brown, of South America, Paris, and at present Munich, sends me a little book, *The Readies,* in which he proposes to substitute rolls of printed tape, displayed to the eye by machine, for the book form of literature. His idea, as he has worked it out, is so logical and practical that it seems almost certain to be adopted. . . . Imagine the equivalent of an entire book printed in microscopic type on a roll of paper tape by a photographic process. The roll, about the size of a typewriter reel, is placed in a machine and connected with a winding spool. A plug is connected with a current source. The reader operates a control. And the words are exposed in a single unwavering line as they pass beneath a slot equipped with a magnifying glass to bring them up to readable size, the reader varying the speed at will. . . . But that is not all. Inventor Brown proposes also to eliminate all articles, prepositions, verbs of being and so forth, unless they are necessary to understanding the narrative flow, and to introduce atmospheric and characterizational words wherever they will add color and point to the story. The result, as shown by a story which he has written to demonstrate the new form, is a marvelous acceleration and compression, and also a vividness not achievable with the language as we know it—almost a new language, one might say. Punctuation would be practically eliminated. . . . Thirty-five percent would be the saving in words, and the saving in paper would be tremendous, to say nothing of the saving in time and the added convenience of the new method. . . . Despite the fact that sentence structure, as we know it, is lost, there is little difficulty in learning to read a narrative in the new Brown manner. It is, in fact, quite easy.

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NUMBER 6

Science and Invention

VOLUME XVIII
WHOLE NO. 210

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Tools

THOMAS EDISON, Henry Ford and Harvey Firestone are generally-accepted exponents of our present machine age. They are men who have used and continue to use all sorts of tools in bringing their mechanical, electrical and physical brain children into being.

Down through the ages the men who have dominated civilization have depended largely upon tools and their intelligent use. Various types of primitive tools and machinery helped in cutting and bringing together the huge stone blocks which make the pyramids. Modern electric steam and air pressure tools are rendering similar service in the erection of our skyscrapers. The design of these aids to building has improved materially and we now have tools and machinery which would do a similar job in very much less time today.

There are few of us who can get along without using tools of one sort or another, occasionally. Their intelligent use can save us many dollars and much time.

Our car, our radio, our home, our barn, and fence, and in some instances our glider or airplane call for a continuous use of tools. Some of us, tired by the mental gymnastics of office routine, can compose our nerves and get great relaxation by building a modernistic table, a new radio or a buckboard for the kiddies. Like the motorman who takes a trolley ride on his day off and the postman who spends his Sundays hiking with a pack, there are many master-mechanics, garage servicemen and plumbers who have their home workshops where they do for themselves the same sort of work which they perform during the day for their employers. The manual-training and shop student frequently finds that he can utilize to advantage, at home, many of the things he learns to make in school.

With this thought for our background and with a view to enabling more of our readers to realize the usefulness and take pride in their ownership, SCIENCE & INVENTION announces a most unique contest, to determine the ideal essentials for a home workshop.

To others among our readers we want to illustrate, upon the conclusion of the contest, just how and just why the expert carpenter, machinist and hobbyist selects those tools which he feels will do the most work, for the least expense, in his home workshop. And we feel very sure that many a doctor, lawyer and business man will show equal sagacity in his selection. Nor have we forgotten to back the youth to finish well up in the lead.

Here is a rare opportunity to show your skill, capture a prize and let other enthusiasts benefit by your experience. The gate is open to everyone and your shop may include all manner of tools, jigs and accessories; tools for wood and metal working, hand-operated and power-operated. The sky is the limit.

Could any contest be more interesting to readers of SCIENCE & INVENTION?

For full details see Page 502.

Arthur H. Lynch

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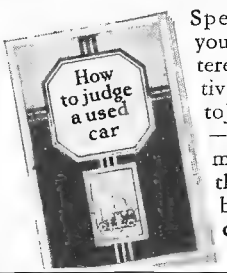

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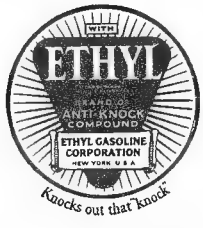

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SCIENCE AND INVENTION

VOLUME XVIII, NUMBER 6

OCTOBER, 1930

Hunting Sharks for Meat, Shoes, and Vitamins

The Terror of the Deep Is No Longer the Total Loss He Once Was Considered . . . In Fact There's a Deal of Net Profit in Him for a Bustling Shark Industry

By Uthai Vincent Wilcox

Special Writer and Correspondent

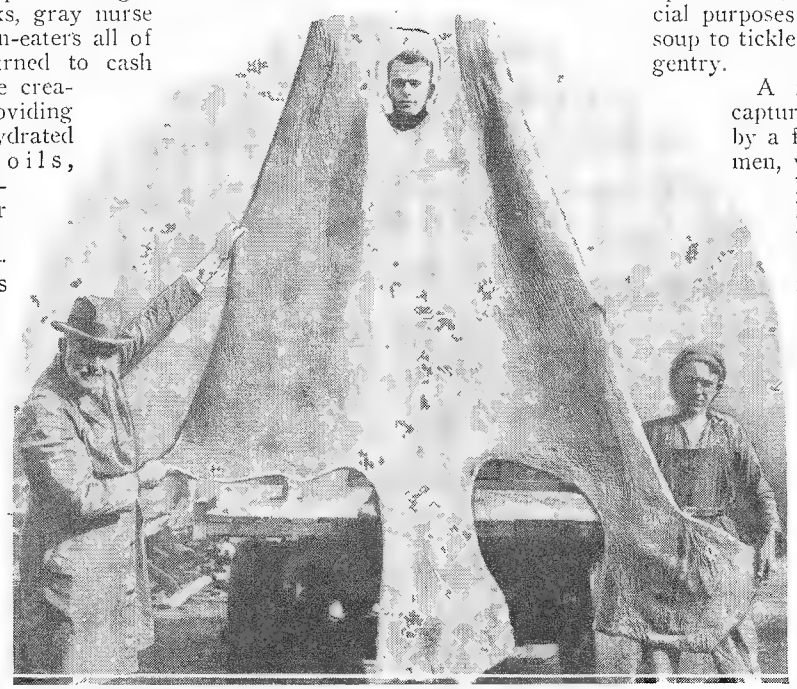
SHARKS—hideous monsters weighing up to a thousand pounds—tiger sharks, whaler sharks, gray nurse sharks, white sharks—man-eaters all of them, are now being turned to cash profit. These fearsome creatures of the seas are providing luscious steaks, dehydrated meats, necessary vitamin oils, and tough leathers, fertilizers, chemicals and other products.

In San Francisco, California, this industry is being established. In Australia and New Zealand, in Florida and Arabia courageous fishermen, under the guiding direction of interested scientists, are securing food, medicines, leathers, and the cash of the country as they capture the despised creature.

Thirty-five sharks in a single net were recently caught during a haul made by these new shark hunters who operated at Fort Stephens, Australia. Five tons of shark fins a month are being utilized for profit at San Francisco, while shark nets are placed on the edge of the Florida Everglades near the town of Marco. The Arab fishermen of Aden find good fishing grounds at Makalla and along the British-Somaliland coast.

Shark fishing for profit is adventure spelled with large letters. Like big game hunting for museums, it has all the elements of danger and the lure of big profits. But commercial-minded scientists have stepped forward to put this new industry on a firm basis that bankers can appreciate for the loaning of investors' money.

Sharks, instead of roaming at large, unmolested, seeking whom they may devour, are thus being pressed into man's service; their hides are converted into most valuable leather, strong, supple, and good to look upon; their flesh is dried to feed the hungry millions of the East and West; their livers are made to give up their oil, useful for many commercial purposes; and their fins made into soup to tickle the palates of the Chinese gentry.



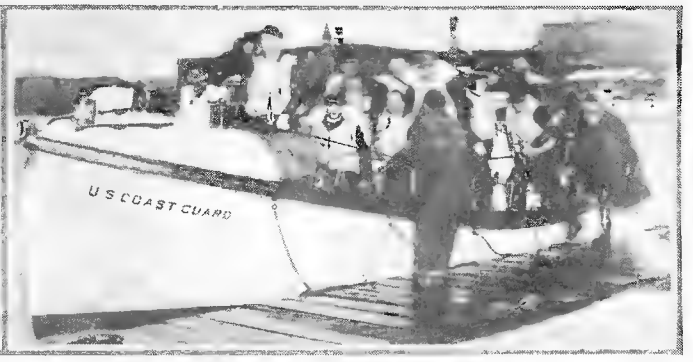
The final form of this handsome skin, taken from a tiger shark off Sydney, Australia, will be handbags and modish shoes . . . Shark leather becomes more of an established commodity each year.

A few short years ago the capture of sharks had been made by a few courageous line fishermen, who for the mere sport of hooking a hard-fighting, hard-dying fish, of pitting their skill against the brute force of the maddened monsters, have fished for them for the sake of their thrill. Now the tough, strong net is used and the sharks' free days are over.

The modern shark fisherman's day begins at half-past two in the morning, when his alarm clock buzzes insistently. He dashes to the boats that operate in pairs, thirty feet long and equipped with twelve horse-power Diesel engines, made and put together to withstand any amount of buffeting.

Half an hour's run through the eerie light of the early star-flecked morning and two floating buoys are observed which mark the end of a net; somewhere a thousand feet away two more buoys mark the other end. In a line between them the net lies vertically on the bottom. Its ground rope is weighted with four-ounce leads every three feet; the head line is buoyed by glass floats, five inches in diameter, every eight feet. Many of the (*Continued on page* 550)

A ship sends distress signals. The crew buckles on lifebelts and races in a surfboat to the rescue. This is the Nauset crew getting its boat through the breakers.



Tough times on the Lakes! The power lifeboat of the Kenosha station comes in with a full load of survivors from the stricken vessel Wisconsin, aground in a heavy winter gale.

Rough seas prevent the Coast Guard cutter from coming alongside a ship in distress. With a shoulder gun a member of the crew shoots a projectile carrying a line across the deck of the beleagured stranger. A towline or a breeches-buoy line will follow.

Being Heroes Regular

In a Single Year of Combat With the Sea, sisted, or Cared for 22,056 People and at $34,479,729 . . . Here, in Pictures and of the Guard's Daily

Text Based on Narratives of E. F. Clark

Here's the mounted type of gun ready to be loaded with a line-carrying projectile. Soon a breeches buoy outfit will be rigged between ship and shore. To keep the line from snarling, it is coiled in a special way on the spindles seen in the background.

Below—The crew of the Coast Guard Cutter Mojave breaks out the ship's twelve-inch hawser, on the way to assist the Shipping Board vessel West Hika. The Mojave towed the West Hika to Boston Harbor from a point 500 miles off Nantucket lightship. This incident took place in April, 1929.

Above—When a boat can't be launched or a projectile successfully used, a seaplane carries the breeches-buoy line. This seaplane, at Section Base 7, Gloucester, has just picked up a shot line from poles, and is flying with it to a vessel theoretically in distress. The new method fills a real need in the Coast Guard's technique, for it permits rescues in weather too rough for lifeboats, from ships beyond the range of a line-throwing gun.

Left—Securing the S. S. West Hika's wire to the anchor chain of the Coast Guard Cutter Mojave, preparatory to towing her to port.

All Pictures, Except One Carrying Special

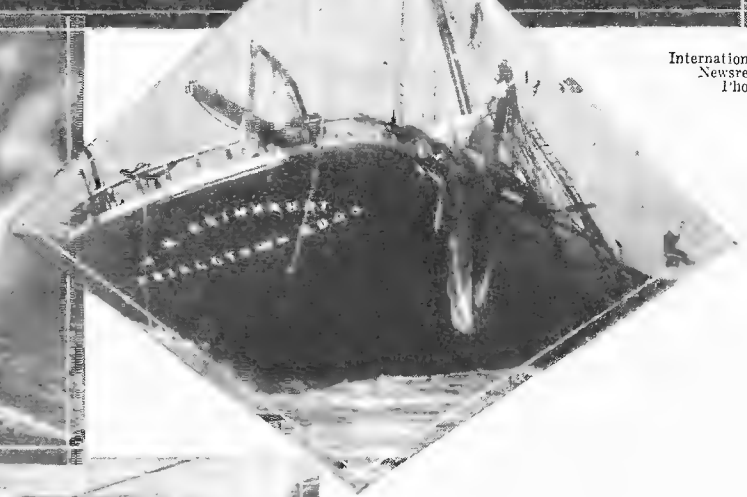
A vessel aground, with a rough sea beating her, off a rocky coast. This situation is one of the most common ones encountered by the guardians of life and marine property along our shores.

Here's work for the Coast Guard—a yacht aground in the shallows, and listing, too, so that the sea threatens to wash completely over her. Such incidents are of almost daily occurrence.

Is Their Job

Our Coast Guard Has Saved, As-Protected Marine Property Valued Prose, Are Depicted Some Phases Gamble With Destruction

All Material Courtesy Commandant's Office, U. S. Coast Guard, Washington

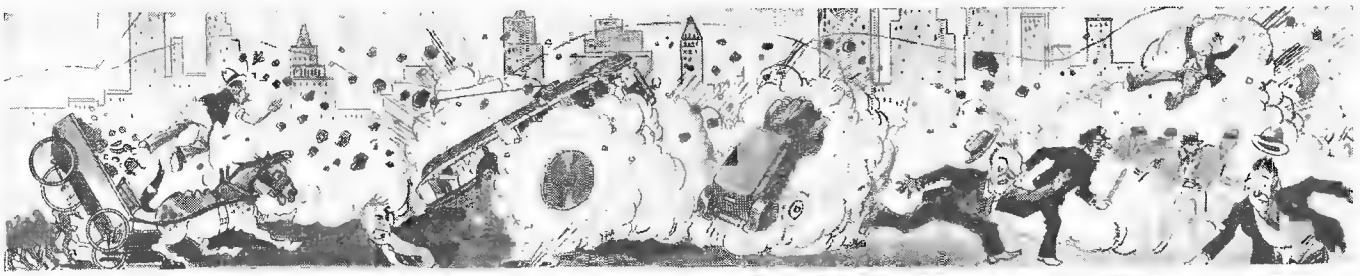


International Newsreel Photo

When Coast Guardsmen are in a very dark corner, with hard, perilous work ahead, they brighten things up with Coston signals. This display took place when the schooner Roger Hickey stranded near Cahoons Hollow Station in Massachusetts.

When a vessel pounds on unreachable rocks or shoals, the breeches buoy plays ace-in-the-hole in the Coast Guardsman's battle with the raging sea. . . . Above is shown a survivor being landed in a breeches buoy at night, on a rocky, treacherous coast. In the diamond-shaped photo, the ocean beats at a ship aground, while a breeches buoy removes a member of the crew to safety. On the left a day rescue by breeches buoy is being completed.

Credit Line, Are Coast Guard Official Photos



When Broadway Went Up in the Air!

By H. W. Caslor

Illustrations by Leo Morey

NEW YORKERS got a startling and unexpected glimpse of their city's vast underground arteries of communication on April 3rd, when a series of gas explosions skyrocketed manhole covers and large portions of the pavement of Broadway in the vicinity of Twenty-ninth Street. The explosions and fires resulting therefrom caused what was in many respects the worst telephone disaster in the history of the metropolis. Due to the severed gas mains and disrupted telephone and telegraph lines at this vital point, business in a large area of the city was practically paralyzed.

When the fires were subdued and the wreckage examined, it was discovered that twenty-nine trunk cables containing 7,500 telephone circuits connecting central offices, 3,000 miscellaneous circuits including private wires, and eleven other cables containing more than 4,500 circuits serving subscribers in central and eastern Manhattan had been put out of commission.

While most of the damage was wrought in three of the charred and wrecked manholes, ten manholes in all scattered along Broadway from Twenty-eighth to Thirty-first Streets were involved in the catastrophe, doing damage to the telephone plant estimated at $135,000. Long sections of cable of various sizes be-

The pictures above show the tangled ruin of conduits and cables left by the April explosion.

Above — Workmen gather for repair work under the shattered street. Left — New cable at the scene of action.

Photos New York Telephone Company

tween the manholes, including 98 sections of the main underground cable and seven subsidiary sections, making a total of 32,861 feet or about six miles, had to be replaced. This cable contained nearly 60,000,000 feet of wire, enough to (*Cont'd on page* 541)

Wonder what a Soaring Pilot Thinks About?

Wolf Hirth himself, sitting pretty amidship on the wing of his champion soaring plane, Lore.

By Wolf Hirth

Pioneer International Soaring Champion

Translated by Martin H. Schempp

MOST people I meet ask me again and again "But while you are soaring for hours away up in the air, don't you feel bored at all?"

I answer: "I am sorry, no—because one is always kept very busy."

First, after one has played the stone in the big sling-shot and is hanging far above the scenery, one glances toward the barograph instrument and sees that it has stuck and does not work as usual. One nearly sprains one's back in looking for the cause, and the flying plywood box is losing 100 feet of altitude in the meantime. If there is just a little wind, one has to linger around every crag, regardless of its size, to be able to stay up at all. If there is plenty of wind, on the other hand, the whole army of competitors is humming around like a swarm of mosquitoes, and one feels like calling a traffic cop.

Suddenly one of these (literally) "birds"—it is Schulz in a two-seater—is heading for me. Shall I make way for him? I should say not. I am going to pass by underneath, nosing down. Tough luck, he has the same idea. Now both of us are diving. Thank goodness, he pulls over just ten feet above. His passenger, Hauptmann Koehl, the ocean flier, is waving in a relieved manner.

When one has been up for some time one becomes interested in what is going on below. For instance—in how the training gliders start and land. Once in a while one distinctly hears an awful crack. Then one knows that some pilot in landing has failed to come to a peaceful agreement with a rock which happened to be in his path.

Presently the ground hoppers seem to have disappeared. Ah, it must be five o'clock—time for lunch. The thought awakens a reflection. Didn't I put my ham sandwich right here underneath the seat? Here are the bread slices and waxed paper—but where is the ham?

There it is—far back in the fuselage; I can see it perfectly. Well, there are other people who don't have ham for lunch.

After another hour the air is again filled with gliders. Look over there. There is "Alex," with a soarer of his own design. He is able to stay at one spot in the air in the slightest wind, while all the rest of us must cruise and curve. His plane, therefore, is called the "kite." It is also said that its pilot feels a wind gust before it reaches the plane, because of his stretched, swan-like neck.

I do not want to hurt the reputation of my comrades by repeating their hearty calls to the ground crew or to their soaring comrades.. . . . Suffice it to say that one can find no science in their words.

The ground organization of some aces is wonderful. There are large plates laid on the ground, telling the wind velocity. When a rival pilot appears these plates are turned over in all haste. Some others put little flags all over the slope to indicate the most vigorous air currents. There is a bunch of boys playing the accordions to influence the endurance of their pilot. And yet I know so well that it is not the musical forehead of the pilot that is important in an endurance flight. It is some other vital part of his body. If this part starts hurting and quits, all the windplates, flags and bands are in vain.

It is getting evening and therefore naturally darker. Most of the ground loafers and training gliders disappear. The "Rhoenspirit" in daily life, Herr Ursinus by name, is lighting big wood fires to brighten the path of a few optimists like me, who are still in the air. The chances of a collision with one of the beloved rivals is getting better every half-hour.

What strange sounds are touching my ear? A choir is singing with powerful voices something that sounds like the hymn *Do Not Despair in the Dark*.

The fires are dying away; I hear the advice from below to land. And now *everybody* seems to be in a hurry to get to the ground. They have hardly time to pull the machines out of the way.

An excited commotion stirs the dining-room of the glider camp. The soarer pilots seem to be worse than sailors in boasting about their adventures.

WOLF HIRTH is already known to readers of SCIENCE AND INVENTION as one of the outstanding soaring pilots in Europe and a pioneer in the soaring art . . . He is mentioned prominently in the story, "Riding the Thunderclouds," May number, by Martin H. Schempp, who studied gliding under him at the University of Stuttgart. As this article is being edited, Herr Hirth, with a companion, Oscar Weller, is starting a flight in a 770-pound plane from Berlin to Chicago, by way of London, the Orkney Islands, Iceland, and Greenland. Before he became a soaring pilot, Herr Hirth was a champion motorcyclist. He lost a leg in a motor accident in 1925, but it is apparent that the amputation failed to reduce his capacity for action in the least. In 1929 he won the Hindenburg Prize for gliding.

Wolf Hirth's famous soaring ship, Lore, riding the upwinds above the Rhoen Mountains.

The spirits of soaring enthusiasts are not easily damped. . . . These smiling faces are giving the ha-ha to tough luck through the well-torn wing of a ship that has cracked up in landing.

Making Big Ones Out of Little Ones

By
J. P. Sharpe
Superintendent of Construction, Metro-Goldwyn-Mayer Eastern Studios; Pathé Sound Studios

Reconstruction in miniature, for movie purposes, of a building put up in 1893.

Below — A mere yard in height, this set, when projected, gives the illusion of natural size.

Below is shown, in diagram, the composition of the miniature dam set which appears at the left. . . . Note the trigger which permits a catastrophe to occur whenever the cameraman gives the signal. . . . Lower right—Trimming the sponge trees which serve as the foliage in the scene.

THE wall sconces illuminating the projection room faded with the click of the electric button in the operator's booth. The white screen at the end of the darkened room suddenly leaped into illumination as the trailer fed through the projector, and then perceptibly darkened as the subject matter came upon the screen: A wall of water flooded through valleys, over former river banks, and spread devastation far and near as it went its relentless way. Movies of ruined houses, broken bridges, twisted railroad tracks, showed continuously on the screen. The picture ended; and with the same click of the electric button, the room was illuminated.

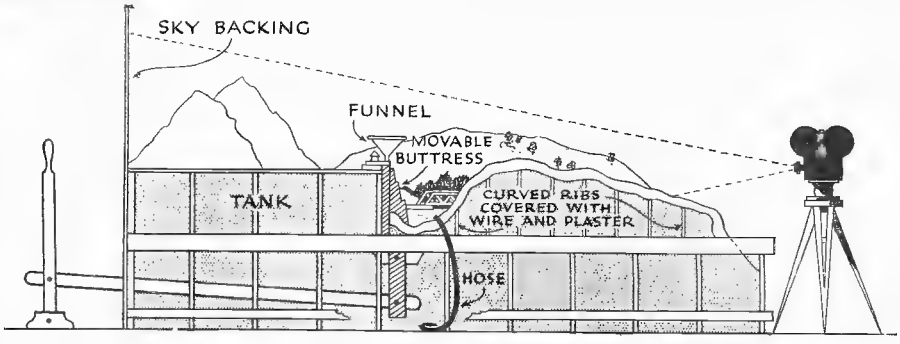
"There, gentlemen," said the director to the spectators who surrounded him, "is the section of the newsreel featuring the Mississippi River flood this company purchased for background in our next feature, *Beleaguered*. The story is of a young engineer; his appointment as chief on a large construction job; and his deception by his enemies, who engineer to weaken the dam he is constructing by faulty materials. The dam collapses. The hero's disgrace and subsequent vindication follow."

The destruction of a real dam is beyond the flighty imagination of any movie executive, so he has to resort to deception to realize a picture of a mighty dam falling before the tremendous weight of a lake of water.

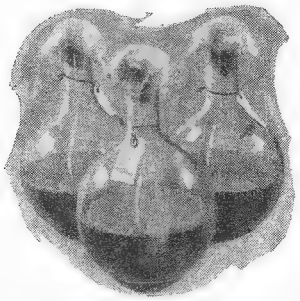
The scenario, in part, will consist of the following: a flash of the weakening dam, rivulets of water penetrating the massive masonry, flashes of the peaceful settlements lying along the river valley, sections of the story being narrated, a quick flash of the collapsing dam, and then cuts of the real flood taken by some news photographer, probably, months previously. All interspersed with shots taken of actors, who carry out the story in sets and locations especially built for this particular story.

Let us follow that branch of this industry devoted to securing a motion picture of a mighty dam collapsing and spreading ruin before it. This, in motion picture parlance, is called the "miniature department."

A plan of the proposed construction is drawn. The size or scale of this plan will be largely determined by the distance the cameras would be away from the dam in a real picture. One-half mile, one mile? Let us for argument's sake, (*Continued on page* 566)



Deadly Germs to make You Well



Flasks of bouillon each containing billions of deadly microbes.

By William H. Baldwin

The World's Largest Germ Incubator Can Produce Enough Diphtheria Toxin in One Week to Wipe Out the Entire Population of the United States, Canada, Mexico and Argentina. From These Germs, Serums and Antitoxins Are Produced for Combating Many Diseases

LITTLE children are being freed from the menace of diphtheria because in certain carefully guarded places the germs which cause this disease are being sedulously cultivated by the billions under the most ideal conditions for their growth.

The dread of lockjaw as an aftermath to injuries is being eliminated because the tetanus bacillus is being similarly incubated.

Likewise, the germs which cause typhoid, epidemic meningitis, scarlet fever, gas gangrene, whooping cough, pneumonia and other diseases are being deliberately propagated in order that science may forge from them the weapons for combating the scourges of mankind for which they are responsible.

We have often heard of incubators for babies, chicks, plants and other delicate things, but the layman does not realize that there are also incubators for the cultivation of those germs which he most fears. And yet there must be hundreds of these throughout the world, in the laboratories of national and municipal governments, universities, research foundations and commercial institutions; because the first step in the creation of serums and antitoxins is the identification and study of the disease germs themselves.

The world's largest germ incubator is located in Detroit. It occupies hundreds of square feet in the Research and Biological Laboratories of Parke, Davis & Company, and contains many thousands of flasks of nice, healthy germs and the poisons which they produce in the process of growth and reproduction. This incubator is so large that if it were given over entirely to the production of diphtheria toxin, or poison, enough would be produced in a week to kill 144,000,000 persons, assuming, of course, that the poison were properly administered. The thought becomes a bit more staggering, perhaps, when it is realized that this number of people is more than the combined population of the United States, Canada, Mexico and Argentina.

The man with the microscope is examining diphtheria cultures for purity.

It is here that typhoid cultures are harvested.

It is perhaps disturbing to the lay mind to imagine what might happen if these germs (or bacteria, as the scientist calls them) got loose. But the scientist never worries about waking in the morning to find that his germs have escaped. The germ is too well controlled by him. If this statement does not satisfy the average man, if he wants to know what might happen if a large flask containing billions of deadly microbes were to drop on the floor and break, the scientist will quickly tell him:

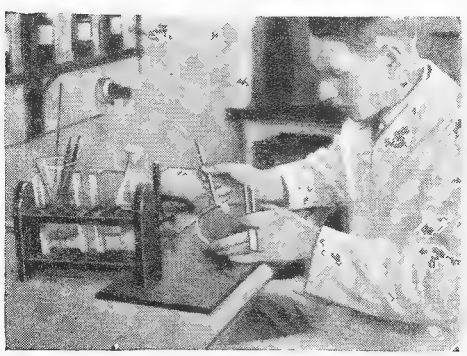
"We don't drop flasks here."

But if you must ask what would happen in case . . .

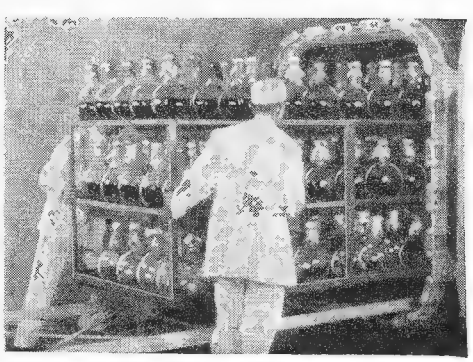
"We have (the scientist would answer) a bottle handy for such emergencies. It contains a powerful disinfectant. If a flask did drop, this solution would be poured immediately over the spilled contents. Every germ would be killed and the danger of infection of the laboratory worker removed entirely."

The purpose of the incubator is to propagate bacteria under natural temperature conditions of body heat so that they will give off poisons. These poisons, or toxins, will be utilized to make serums that will protect man against the very diseases for which the poisons, and the germs which make them, are responsible.

The visitor might well stare a germ incubator full in the face without having any idea he was looking at the comfortable home of untold numbers of harmful bacteria. In fact, if he had any ideas on (*Continued on page* 570)



Transferring a culture to a plate of agar. Under conditions suitable for growth, one diphtheria bacillus would have more than 143,000,000,000,000 offspring at the end of twenty-four hours.



Loading the autoclave. This incubator, if given over entirely to the production of diphtheria toxin, would produce enough poison in one week to kill 144,000,000 people.

Can You Select Ideal Equip

SCIENCE AND INVENTION Offers a Total of $3,250 in Fine Tools to the Fifteen People Who Do It Best . . . Read

IF you had available a certain amount of money to spend on equipping a home workshop, what tools and equipment would you buy?

SCIENCE AND INVENTION will spend $3,250 on fine tools and equipment and present them to the fifteen people who answer this question most effectively, in the judgment of a picked committee.

Here's the problem: You want the tools and equipment you buy to perform as many functions as possible. To serve for many constructor purposes and for the widest possible variety of household and other repairs. And yet, you want the tools to be of *known, certain quality*—you want them to be *trustworthy, accurate, strong,* and *durable*. You want saws and cutters that will stay sharp, wrenches that will grip tightly under pressure, rules whose figures mean exactly what they say.

These are *two* of the factors. The *third* is the amount of money you have to spend. It's a budgeting job. On paper, you balance the first factor—COMPLETENESS OF EQUIPMENT—against the second—QUALITY OF EQUIPMENT—and the third—MONEY AVAILABLE. And the fifteen prizes, in fine tools and home workshop equipment, go to the entrants who select the MOST and the BEST tools and equipment for the AMOUNT OF MONEY named by SCIENCE AND INVENTION.

If you are among the winners you will be glad to know that the tools and equipment awarded you will be *exactly those which you select in solving the problem outlined above.*

If your winning selection, however, duplicates certain tools or equipment you already have, we shall replace them with any others you desire, provided the total cost is the same.

Three Divisions—Fifteen Prizes

There will be three divisions, and in each division five prizes will be awarded. You can enter any of them or all of them. The method of entry is the same.

In the *first division,* you select the ideal tools and equipment you would buy if you had $50 to spend.

The prizes in this division are five sets of tools and equipment for the home workshop, each costing $50 at the manufacturers' list price. Tools and equipment will be exactly those selected by the winners.

In the *second division,* you select the ideal tools and equipment you would buy if you had $200 to spend.

The prizes in this division are five sets of tools and equipment for the home workshop, each costing $200 at the manufacturers' list price. Tools and equipment will be those selected by the winners.

In the *third division,* you select the ideal tools and equipment you would buy if you had $400 to spend.

The prizes in this division are five sets of tools and equipment for the home workshop, each costing $400 at the manufacturers' list price. Tools and equipment will be exactly those selected by the winners.

Win One of These Fifteen Prizes

Five Prizes of $400 Each
Five Prizes of $200 Each
Five Prizes of $50 Each
In Fine Tools and Home Workshop Equipment

How to Do It*

Get hold of a representative group of manufacturers' catalogues. Pick manufacturers who make tools and equipment of established quality, reputation, and dependability.

Write down the names of the tools and equipment units you feel would be essential to the ideal home workshop, and after each write the manufacturer's name and the list price as you find it in the catalogue. Try to make your list as complete as possible within the limit of the amount of money allotted in each of the three divisions. As before stated, you may make up and enter lists for any or all of the three divisions outlined above.

For each list write a statement of from 200 to 500 words explaining why you chose the tools and equipment you did. Send in the letter with the list. The letter will be taken into consideration by the committee in awarding the prizes. We don't care whether the letter is written prettily. We do want it to give reasons that are to the point.

There are no strings attached, and no money involved on your part. You do not obligate yourself in any way.

Winners in the Ideal Home Workshop Equipment Contest will be announced in the April, 1931, number of SCIENCE AND INVENTION.

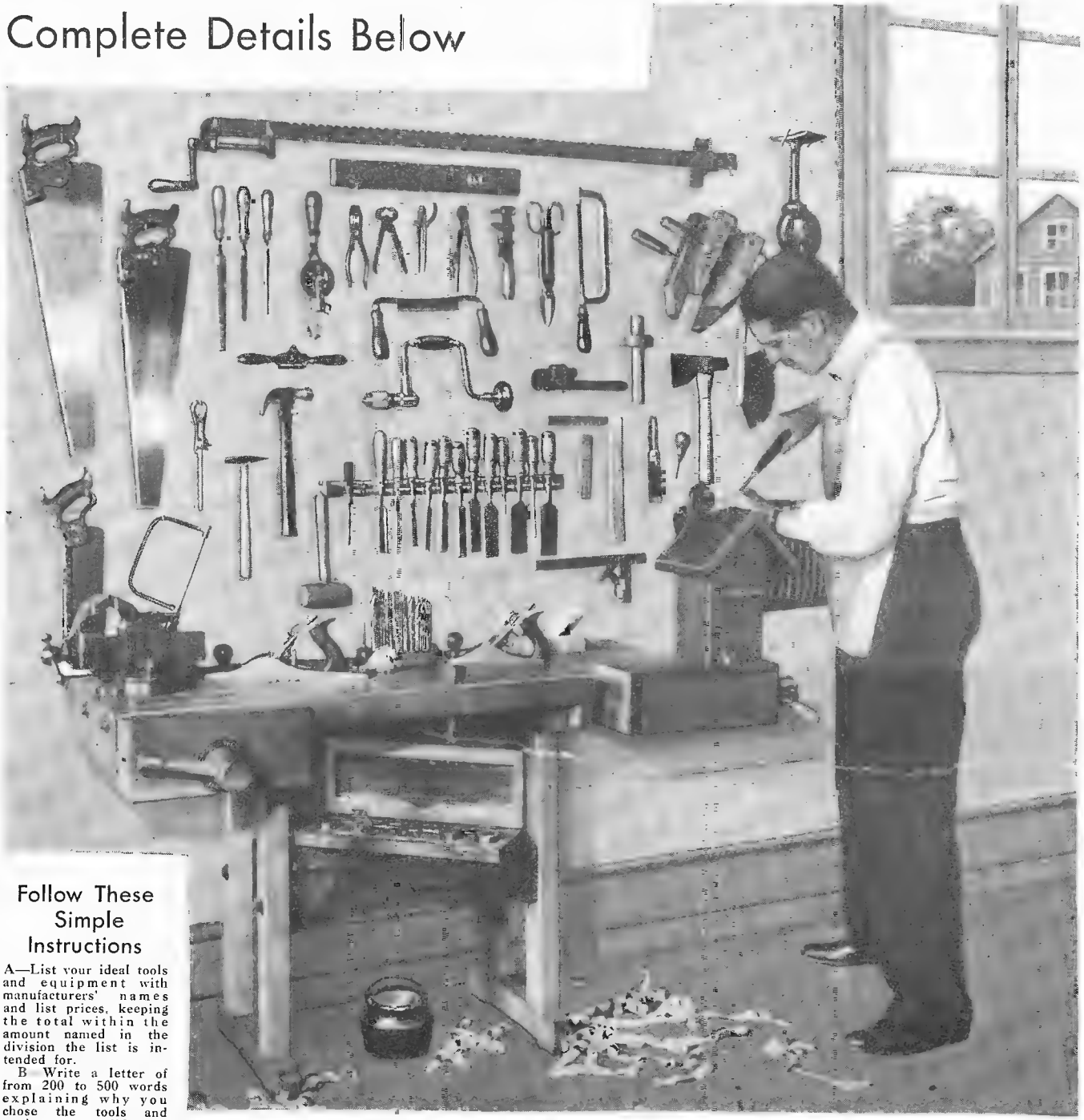
Machine Tools, Motors, and Miscellaneous Working Equipment Will Be Considered in This Contest

SCIENCE and INVENTION Offers $3,250 in Prizes

*We want all the data we can get on the ideal tools and equipment for the home workshop. To help you in making your list, we shall be glad to see that you are supplied with a representative group of manufacturers' catalogues. Drop us a line saying you wish to enter the contest. We'll do the rest.

ment for a Home Workshop?

and Home Workshop Equipment Complete Details Below



Follow These Simple Instructions

A—List your ideal tools and equipment with manufacturers' names and list prices, keeping the total within the amount named in the division the list is intended for.

B—Write a letter of from 200 to 500 words explaining why you chose the tools and equipment you did.

Arranged especially for SCIENCE AND INVENTION by Hammacher, Schlemmer & Co., Inc.

Contest Rules

1. Entries must reach our office, 381 Fourth Avenue, not later than midnight, December 24, 1930.

2. Only one prize will be awarded to any winning contestant, but you may enter lists in any or all the divisions.

3. The contest is free and open to everyone. You need not be a reader of SCIENCE AND INVENTION to enter.

4. In case of ties, tying contestants will receive prizes of identical worth according to the division involved.

5. Neatness of lists and pointedness of letters will count in the awards.

6. No employees of this magazine or members of their families are permitted to enter the contest.

7. The decision of the judges will be final.

8. The winning lists will be those in which completeness and quality are best combined, in the judgment of the committee, within the money limits of the divisions involved.

to Those Who Can

The Right Diet for your Outboard

By J. Phillips Dykes

Rear-Commodore and Secretary, American Outboard Association

The "Pep" Fuel Sirens Extend Sweet Lures to the Outboarder . . . But J. Phillips Dykes, Than Whom There Are Few Cannier Pilots, Advises Keeping Your Course in Every Case Except One . . . In This Story He Tells You Why

NEARLY every outboard enthusiast has at one time or another decided that he has discovered a fuel that will revolutionize the game and win races galore! Usually the net result is the purchase of a new motor and the fervent resolve never to put anything in the gasoline tank except that well-known fluid called "gasoline"!

The reasons are many and quite obvious! Nearly every manufacturer of two-cycle engines, aerial, marine or stationary, has experimented with many forms of doctored fuels, including naphtha, benzol, alcohol, kerosene and gasoline of many different tests.

Not a single one has ever discovered a better fuel than plain, unadulterated straight run gasoline of sixty proof or slightly better, or the same fuel treated according to the ethyl formula.

To begin with, in a two-cycle motor, the gasoline must act as a vehicle for the lubricant. This means that both gas and oil must mix well and thoroughly to insure proper distribution, and yet separate just as easily in the combustion chamber to insure proper lubrication.

It is obvious that in an engine where oil and gas are introduced together into the firing chamber, there will be considerably more residue and carbon than in the motor burning clean gasoline alone. Add to this the fact that your outboard turns about twice as fast as the engine in your automobile, and you can readily see why it is so necessary to clean out the carbon in an outboard at frequent intervals, especially in a racing motor where the power peak must be maintained at all times to insure efficiency.

What happens when we mix foreign substances with our gasoline? To be sure, we can make a hotter explosion, a faster explosion and a more powerful one.

The layman will say, "Well, doesn't that mean more revolutions and therefore more power and speed?" The answer is emphatically No! And here's why!

Picric acid (a dangerous explosive and poison), ether (not the medical sort used for anæsthetic purposes), all of the lead fluids (except ethyl), naphthalene, camphor and the whole list of so-called "pep" fluids are short cuts to an early grave for the motor and in many cases the driver himself.

Grouping them as a whole, to save time, we can say this: When added to ordinary gasoline, they *do* increase the force of the explosion. *But* they also increase, in large proportions, the heat of the explosion, throwing a strain on metals and alloys never intended for them by the manufacturers and often generating such heat as to melt pistons and cylinder heads and otherwise to injure the motor.

You may wonder why the lubricant does not function even though there is a great increase in heat, especially in the present-day high viscosity oils. The answer is simple.

Take a section of ordinary window glass about six inches square. Pour a small amount of any good lubricating oil on the glass. Next drop a spoonful or two of your favorite adulterant on the oil. What happens will be a revelation to even the most experienced outboarder! In short the high-pressure, dry-explosion "pep" getters will cut the molecules of oil, breaking them down, so that when the heat of the explosion occurs the oil will nearly all burn with the explosion, leaving none to lubricate moving parts! An ordinary magnifying glass will help in this experiment.

A few hundred revolutions at high speed, with the oil cut by your adulterant in the gasoline, and there just won't be much left of bearings, cylinder heads or pistons! Take the advice of one who has learned through bitter experience—leave fuel experiments to the laboratory experts and avoid many headaches!

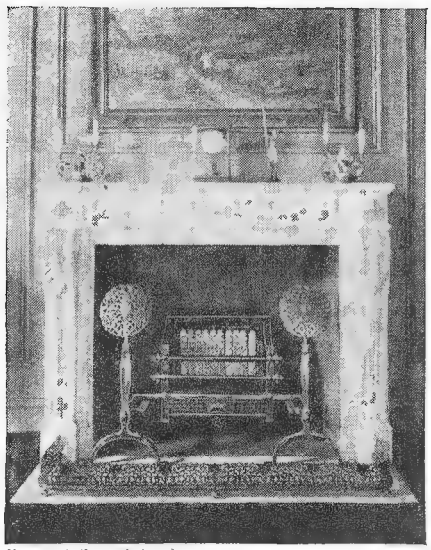
If, after reading this, you still wish to experiment a little, take any good, standard grade gas and add 20% pure benzol. Add 25% more oil to the mixture, however, and if you are using an ethyl-treated gas add 35% more oil. This mixture seems to add a few revolutions, and as long as no heavy loads are added to the propeller is comparatively safe. (*Continued on page* 540)

ARTICLES of this type can cover only in a general way a subject that in many cases calls for detailed treatment. If Mr. Dykes can help you solve any problem regarding hulls, motors, parts, fuels, racing rules, the formation of clubs, or the managing of regattas, let him know. He'll be glad to give you all the information at his command. Write on one side of the paper and enclose a stamped envelope for his reply.

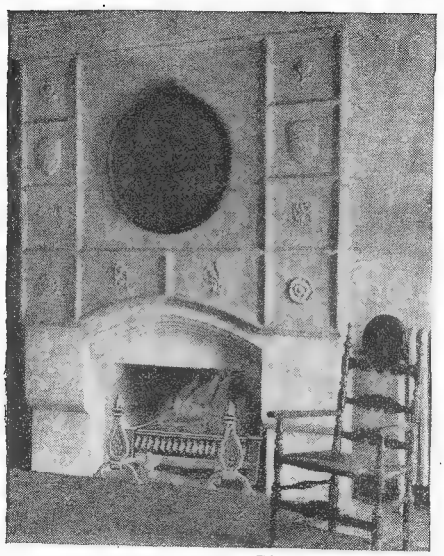
Be brief and specific. Questions likely to interest many outboarders will be answered in these columns. Otherwise your problem will be treated in a personal letter from Mr. Dykes or from some other authority on the subject involved.

The Value of a Fireplace Depends on Its Construction

By W. D. Will



General Gas Light Co.



The Donley Bros. Co.

IT has been conservatively estimated that eighty per cent of all fireplaces smoke, will not draw or have some other defect. These troubles are due to practically one cause —improper construction. By following a few simple rules, difficulties can easily be eliminated.

In Colonial days Benjamin Franklin and Count Rumford worked on the fireplace problem and the latter wrote a book in which he gave directions for building a fireplace that would give plenty of heat and would not smoke. Though Count Rumford's ideas have never been improved upon with the exception of the addition of a damper, fireplace builders continue to make mistakes in construction.

There are eight simple rules that assure a successful fireplace. First, the builder must be sure that the fireplace will be fitted in size for the room in which it is to be placed.

It frequently happens that a home owner sees a big, magnificent fireplace and wants it duplicated in a small room. This error generally results in overheating the room. If the fireplace is made too small, there is a lack of heat.

The second, and probably the most neglected point in fireplace building, is the relationship between flue and fireplace opening. The rule is simple. The net area of the flue should be 1/10 the area of the finished fireplace opening; if it is less than 1/10, the fireplace is almost sure to smoke.

Third, every fireplace should have a damper of the same length as the width of the fireplace opening. That damper should be in the front of the fireplace (see Fig. 3) and six to eight inches above the level of the fireplace opening. Countless builders still insist on putting the damper against the back wall or on a level with the fireplace opening, and many use too small a damper.

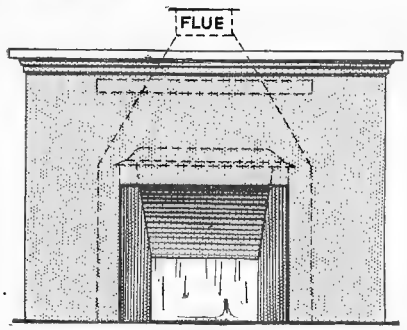


Fig. 1

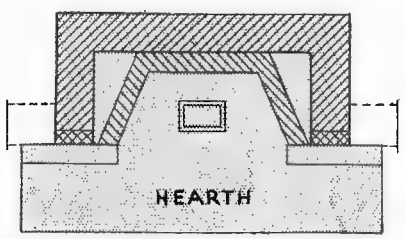
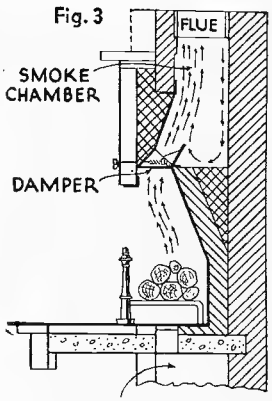


Fig. 2

Fig. 3



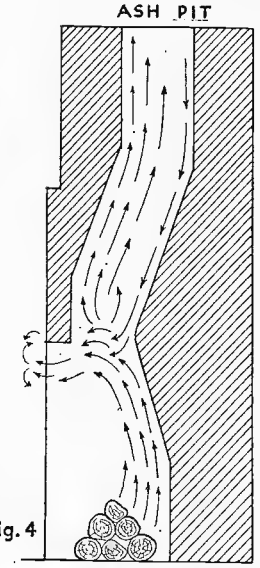
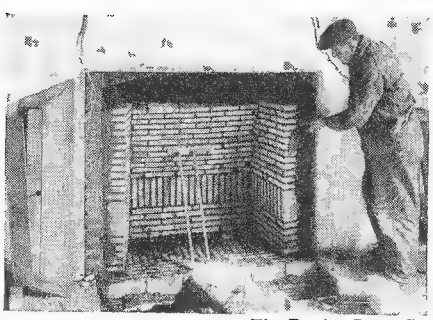


Fig. 4

In Fig. 1 is shown the correct size of the damper with relation to the fireplace; its correct position is shown in Fig. 3. The latter diagram also shows the correctly shaped smoke chamber and the shelf to deflect the downdraft up the chimney. Fig. 2 indicates the right slope for the sidewalls. In Fig. 4 the construction is such as to drive smoke into the room. Below—Completing side and rear walls of a modern fireplace.



The Donley Bros. Co.

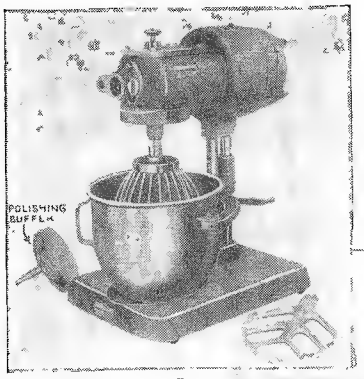
The fourth point in successful fireplace building is a pyramid smoke chamber (see Figs. 1 and 3) immediately above the damper and leading up to the flue. In countless fireplaces this smoke chamber is left out and the flue brought down to the top of the damper. Sometimes the sides of the smoke chamber are sloped unevenly, producing a fire that burns on one side and not on the other.

You will notice in Fig. 3 a shelf immediately back of the damper. This is the fifth point in successful fireplace-building. This smoke shelf must be present to take care of downdraft, for in all chimneys downdraft is present. In proper construction the downdraft hits the smoke shelf and with the aid of the back of the damper valve plate is curved back up the chimney, taking smoke with it. Without the smoke shelf the downdraft forces the smoke back into the room.

The sixth point is the height of the chimney. A chimney lower than the roof line is quite likely to cause a smoking fireplace. Wind hitting the roof is curved down the chimney. The same thing occurs when a tree is to close to the top of the chimney.

Our seventh point might be labeled obstructions. Quite frequently a small chimney-pot or the brick holding the flue lining extends too far into the flue. Either of these factors constricts the area of the flue and lessens the area proportions of 10 to 1 with the fireplace opening. The result is a fireplace that smokes.

The eighth and last point is the construction of the side walls and the back wall of the fireplace opening. If the side walls are splayed or angled in five inches to the foot (see Fig. 2) and if the back (*Continued on page* 558)

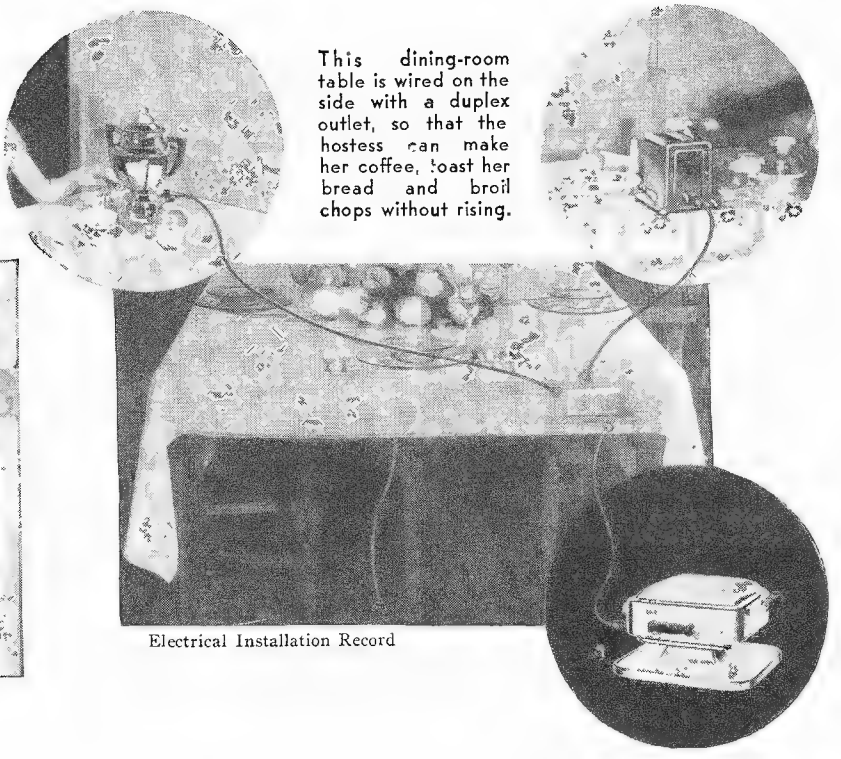


This little jack-of-all-trades for the kitchen with its attachments extracts fruit juices, chops food, slices vegetables, and performs other services.

Gem Appliances, Inc.

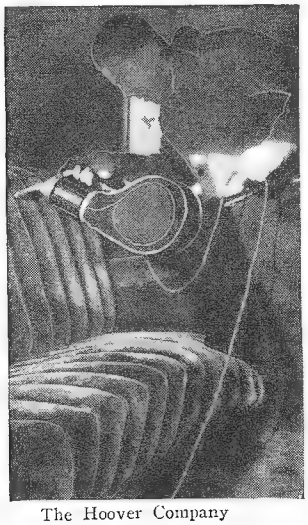
Attach one of these to your cold water faucet in the kitchen or bathroom. Plugging in the cord to the nearest appliance outlet and turning on the current will provide an instant stream of hot water.

Hot Shot Electric Water Heater Corp.



This dining-room table is wired on the side with a duplex outlet, so that the hostess can make her coffee, toast her bread and broil chops without rising.

Electrical Installation Record



For reaching the folds in your automobile upholstery where dust gathers, for dusting your drapes and furniture quickly, thoroughly and easily, use this miniature vacuum cleaner, specially made for arm-reach service.

The Hoover Company

Electricity—the

By S. Gordon Taylor

Research Specialist in Home Planning

This Is the Eighth Article in Our Home Improvement Series by S. Gordon Taylor. The First, Which Appeared in Our March Issue, Dealt with Basement Improvement; the Second (April) Covered Insulating the Home; the Third (May) Dealt with Roofing; the Fourth (June) Was Devoted to Paints and Decorations; the Fifth (July) to Bathrooms; the Sixth (August) to Flooring; the Seventh (September) to Heating. There Is Also an Article on Fireplaces in the Present Issue.

THE electrical installation in any home, existing or proposed, is well worth the careful consideration of the home owner. There is scarcely anything in the house that can do so much to make for the comfort and convenience of the family as the electrical equipment. And not only comfort and convenience. The provision of electrical labor-saving devices may eliminate the necessity for outside help, or reduce the amount of "hired help" required, as the case may be. Moreover, an adequate electrical installation has its influence on the health of the family in preserving foods, eliminating eye-strain and in providing the modern therapeutic and electro-mechanical treatments which are finding increasing favor.

The extent to which the benefits of electrical service are utilized depends upon two things. The first is the electric wiring system of the house, and the second is the equipment employed with it. Unless the house is adequately wired, with a sufficient number of properly located light and convenience outlets, real electrical convenience is impossible. Nor is it sufficient to tack wiring along the baseboards or picture moldings to provide additional convenience outlets. This is a makeshift method which is unsafe and unsightly and which may be heavily penalized in case of fire, because in practically all cases where such wiring is installed in a house, the insurance company can, according to the terms of its policy, refuse to pay claims arising from fire. Likewise, the use of overhead fixtures in place of convenience outlets for plugging in electrical appliances is not a satisfactory substitute for properly located convenience outlets. It is far from convenient to plug attachments in at the overhead fixtures, and it is unsafe, because these overhead lamp sockets are usually wired with relatively small wires, intended only to carry the current required for lighting. When the heavier currents required by such appliances as flatirons, toasters and heating units are drawn through these fine wires, there is a good chance of the wires burning the insulation, starting a short circuit to blow out a fuse, or worse still of starting a fire because of the high temperature resulting from overloading.

The electric wiring system should be installed in such a manner that the wiring is safeguarded against mechanical injury, and the building itself and its occupants safeguarded against the hazards of fire and accident resulting from improperly harnessed electrical energy. There is a National Electric Code which defines the conditions under which each type of wiring material may be used. Also there are codes by local authorities covering their municipalities, and usually more restrictive in their requirements than is the National Code. There is one method of wiring acceptable under all codes. This is wiring installed in standard rigid conduit. The conduit is first installed in a house during construction, just as are the water and gas pipes. It is a mild steel pipe having walls as thick as waterpipe and with a special protective coating for added durability. After the conduit installation is completed it constitutes a pathway for wires, connecting all the outlets in the house together. The wires

¶ A Comprehensive List of Building Material Manufacturers Literature May Be Found in

¶ Are You Getting the Full Benefit of Your Electricity? Have You Enough Switches and Outlets in All Your Rooms to Utilize the Modern Electrical Equipment? To Save Labor and Conserve Health? And Are They Conveniently and Properly Placed? Reading This Article May Save You Time and Money. . . . Should You Desire a List of Free Booklets Covering Electric Wiring for All Rooms. Consult Our Announcement on page 558 of this issue.

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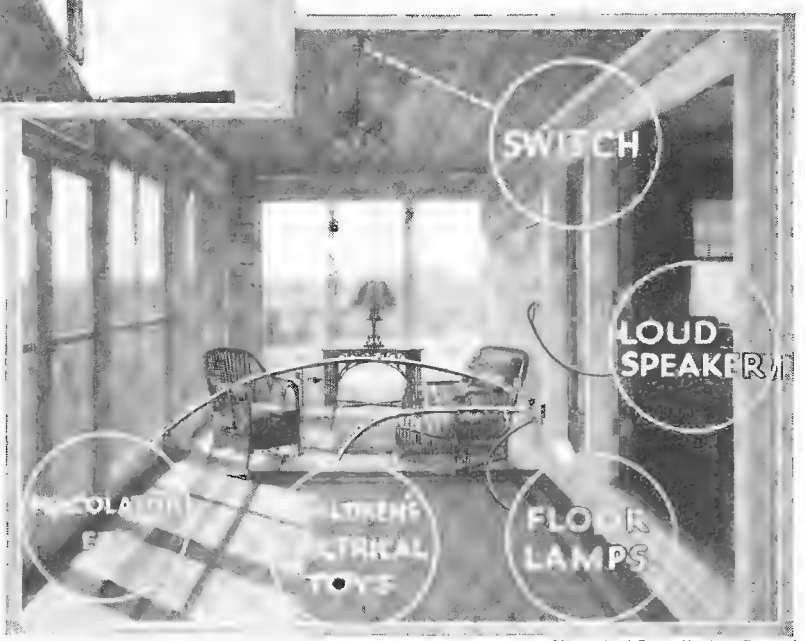
Note the placement of switches and outlets (indicated by circles) for utility and convenience in this California kitchen. Below—Here's how a little forethought in planning the wiring of the porch will add to your pleasure in dining, reading and amusement.



Electrical Installation Record

Home-Maker

are then drawn through and at any time thereafter any of the wiring may be withdrawn for alteration, or additional circuits may be drawn into the same conduits, should the need of additional facilities arise later.

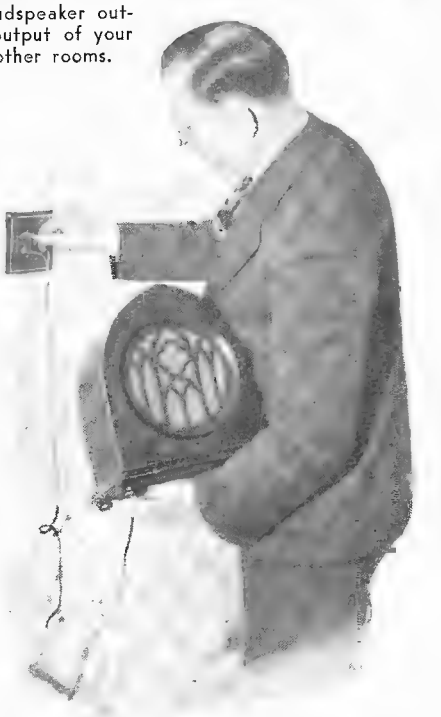
As the only wiring method which is universally approved for use under all conditions because it offers outstanding protection, it is therefore not surprising that this superior installation is slightly more expensive than some of the other types. But the fact that it permits circuit alteration or additions at any future time, without the necessity of tearing holes in the plaster walls, and that it outlasts the building itself, are in its favor. It also has for a talking point the fact that the conduit serves as a perfect electro-magnetic shield. This is important in these days, with a radio in almost every home, because it means that the field of electrical disturbances arising in the electric lines will be virtually confined to the conduit inclosing the wiring and cannot affect radio reception.

Where an existing house is being repaired, or extensions are being added to an existing installation the use of rigid conduit is less practical, because of the difficulty of installing it within finished walls. For such work a metal-sheathed, flexible cable is extensively used. In this connection it might be well to stress the fact that experienced electricians can completely wire an existing house with very little difficulty. It is really astonishing the way they can "fish" wires through walls and ceilings, with very little damage to plaster. By raising floorboards here and there and by working through holes made in the plaster inside of closets or in other inconspicuous places, they can make a complete installation which from the standpoint of both appearance and convenience is equal to wiring installed during construction. Many owners of existing homes hesitate about having wiring extensions installed for fear it will be necessary to run some of the wiring on the surface of the walls. For these it would be worth while to investigate the possibilities offered by modern electrical practices.

There is little to be said regarding the lighting of the home. Standards of good lighting practice seem to be pretty well fixed, except possibly in the case of small out-of-the-way corners which heretofore have too often been neglected. In closets for instance, individual lights installed just above the closet door, and with a pull chain or an automatic

(*Continued on page 557*)

Don't restrict your radio entertainment to the living-room. Loudspeaker outlets connected to the output of your set will amplify it in other rooms.



Bud Radio, Inc.

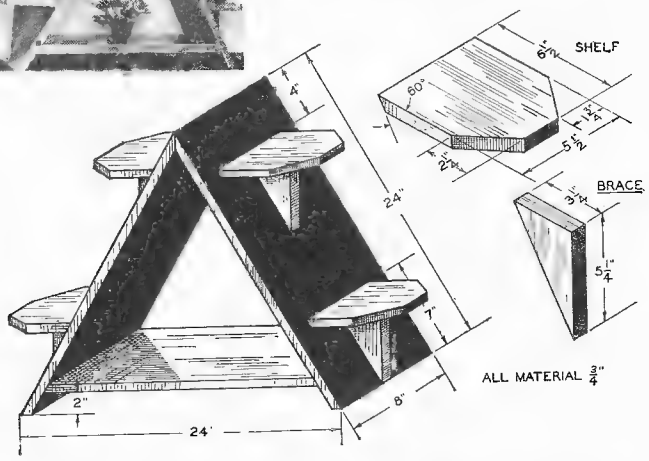
the April, May, June, and September Numbers of "Science and Invention" (See page 558)

Modern Shelves for the Wall, Table and Floor

You Always Need Another Shelf . . . Particularly One that Carries Out the Modern Motif . . . Here Are Hanging and Standing Shelves, Inexpensive and Easy to Construct

By H. L. Weatherby *

Director of Manual Training, Montgomery County Schools, Montgomery, Alabama

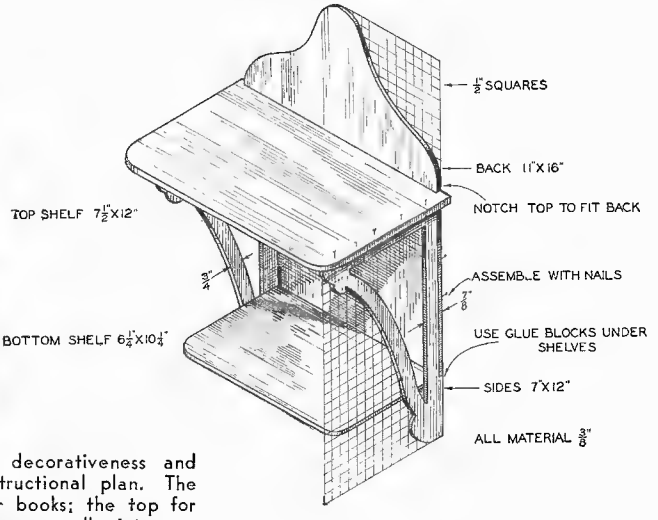


This unusual triangular wall shelf can be made by following the diagram; slightly increase all dimensions for a table shelf.

SHELVES are always in demand. It seems there never was or is enough mantle or table space to properly display the vases, candlesticks, small pictures, bric-a-brac, mementoes and ornaments with which the average woman wishes to decorate her home.

Our grandfathers cut bracket scroll sawed shelves for our grandmothers; some of these are still in existence. But they were elaborate affairs, which required a good deal of practise and time to make satisfactorily. Not all of us have this time and skill, nor do all of us want antiques. This day calls for a modern note in shelves. Here are several shelves—wall, floor, table and hanging varieties—that we can all make with plywood or any other cheap kind. We can cut out paper patterns following the constructional sketches given, and even use a coping saw for making curves. Nails and screws are used for fastening, and a few coats of paint will complete the job.

A shelf that combines decorativeness and usefulness, with its constructional plan. The bottom can be used for books; the top for candlesticks, a clock, or a small picture.



Triangular Shelf

The first one illustrated is built in the form of a triangle, at present so popular a motif of decoration. Its construction is simple, and when finished this shelf will provide just the desired touch of the unusual to the living room. In the proportions given the shelf can be placed on the floor; by decreasing the dimensions slightly it can be used on a table.

It is a true equilateral triangle, each side being twenty-four inches long. The angles of all cuts will then, of course, be either sixty or thirty degrees. Lacking a protector or other device for measuring these angles, it is a simple matter to lay the bevel cuts out by trial.

Having cut all pieces to dimensions, you fasten them together with nails and screws, after which the whole shelf is given a coat or two of paint of the desired color. This is followed by a trim coat on the edge of another color. The writer recommends a soft shade of green with silver edging.

Transfer designs on either side will add to the attractiveness of your hanging book shelf. Method of construction is given in the text.

H. L. WEATHERBY, author of this article, is a sound craftsman in wood, abreast of every tendency in his field, adept at graphic illustration. His articles have appeared in SCIENCE AND INVENTION regularly in the past, and he will continue to contribute material of his own distinctively high standard in the future.

Hanging Book Shelf

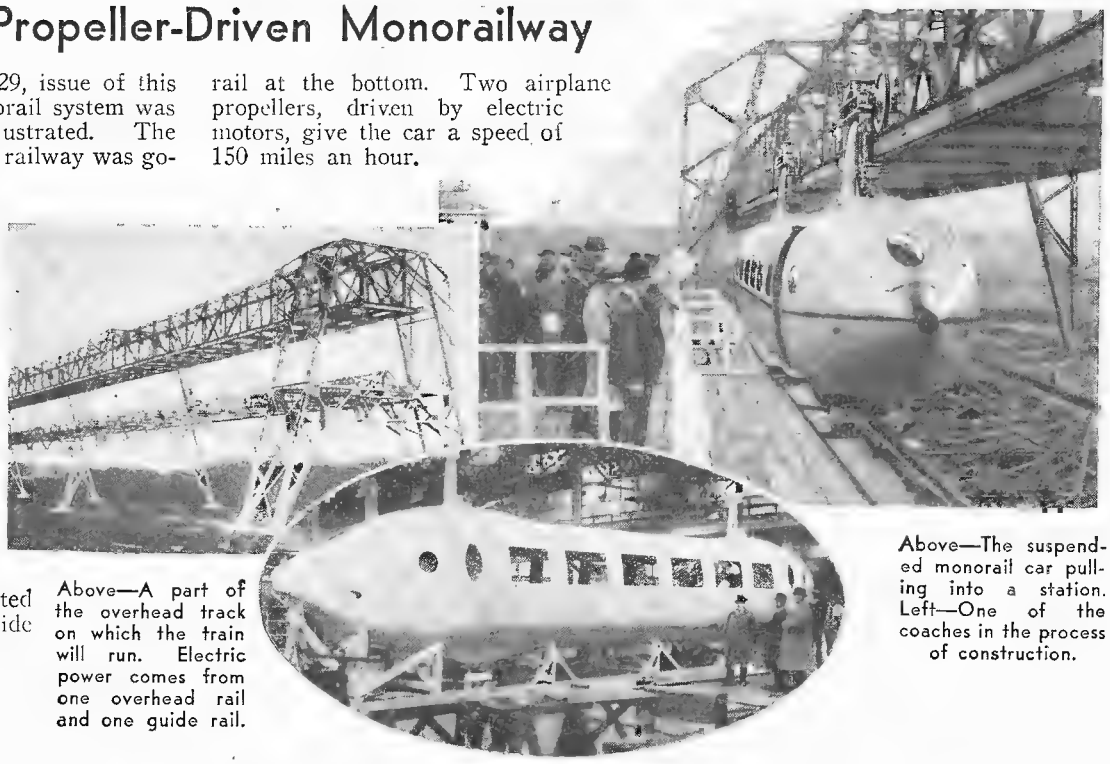
The hanging book shelf proves quite as useful as any small article of furniture could be. It takes up no floor space and yet will care for a dozen books, while the top shelf can be used for a clock, vase, or small framed photograph.

Plywood for an article of this type is more satisfactory than plain wood, and considerable trouble may be experienced with the wood splitting if plywood is not used. This material can often be secured from the local mill in "shorts" or pieces thrown into discard and can in that way be purchased at very slight cost. If the shelf is to be painted, the (*Continued on page* 571)

* Winner of First Prize in July Handicraft Contest.

Suspended Propeller-Driven Monorailway

IN the November, 1929, issue of this publication, a monorail system was described and illustrated. The article inferred that the railway was going to be constructed for test purposes on the line of the London and Northeastern Railway Company at Milngavie, near Glasgow. No definite data was available at that time, but if the reader will refer to that issue, he will see how remarkably accurate was the editor's prediction of the future appearance of this railroad. The cars are suspended from an overhead track and are prevented from swinging by a guide rail at the bottom. Two airplane propellers, driven by electric motors, give the car a speed of 150 miles an hour.



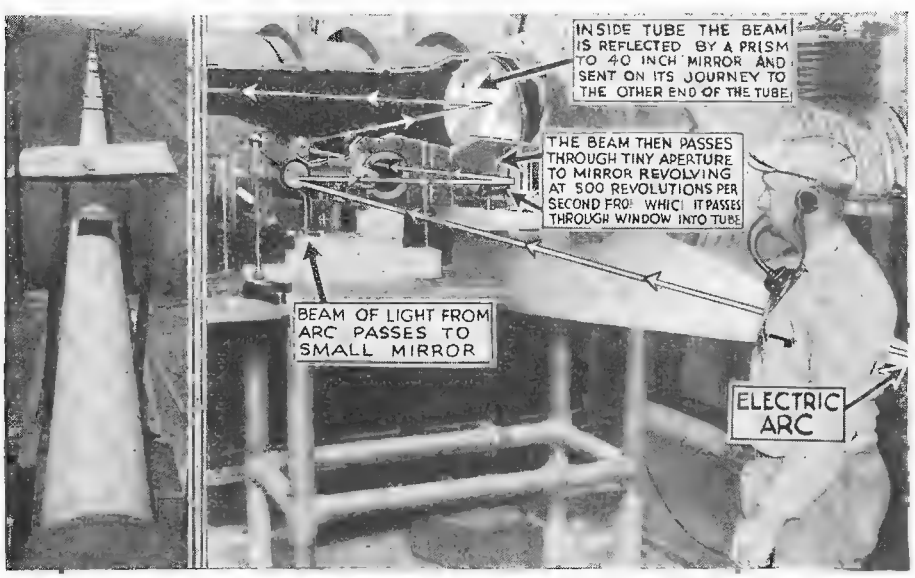
Above—A part of the overhead track on which the train will run. Electric power comes from one overhead rail and one guide rail.

Above—The suspended monorail car pulling into a station. Left—One of the coaches in the process of construction.

In the Spotlight of Science

Testing the Speed of Light

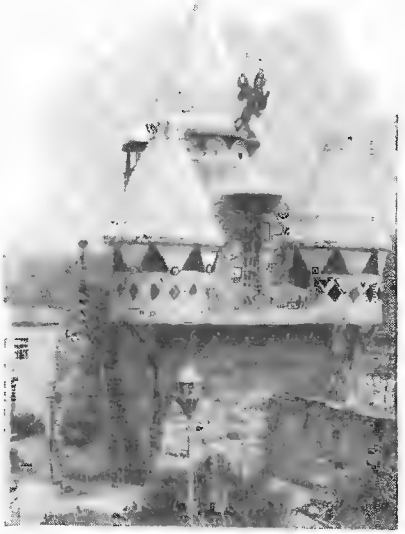
FOR a year the scientific world has been awaiting the completion of a curious vacuum tube one mile long, established just outside of Santa Ana, Calif., with which Prof. Albert A. Michelson, world famed physicist, is to conduct his final and corrective tests of the speed of light. The photo at the left shows the tube. The one at the right indicates an interior view where the beams of light will be reflected from a revolving mirror, and thence to a prism and a 40-inch mirror before being sent on the journey through the tube.


INSIDE TUBE THE BEAM IS REFLECTED BY A PRISM TO 40 INCH MIRROR AND SENT ON ITS JOURNEY TO THE OTHER END OF THE TUBE
THE BEAM THEN PASSES THROUGH TINY APERTURE TO MIRROR REVOLVING AT 500 REVOLUTIONS PER SECOND FRO WHICH IT PASSES THROUGH WINDOW INTO TUBE
BEAM OF LIGHT FROM ARC PASSES TO SMALL MIRROR
ELECTRIC ARC

Another Sinanthropus

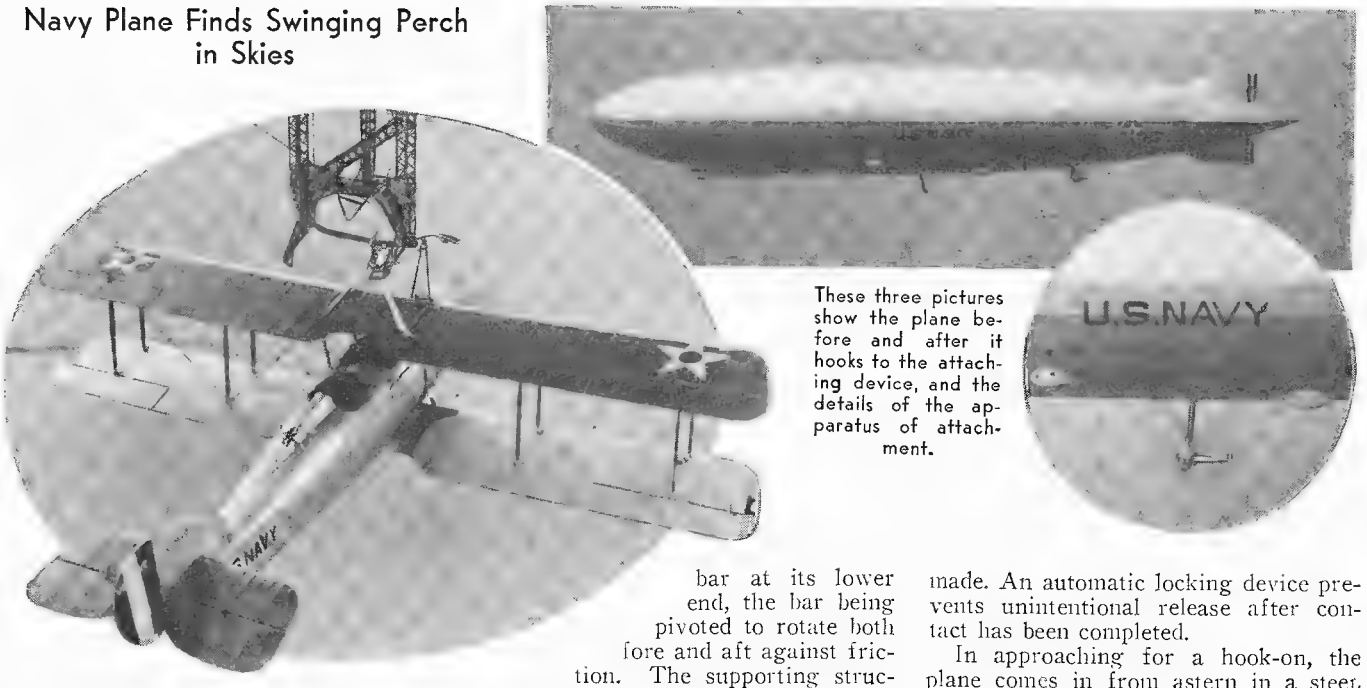
DISCOVERY of a second Sinanthropus skull was announced by Dr. Davidson Black, of the Rockefeller Foundation at Peiping, China. The new specimen was pieced together from uncrushed fragments. These two Chinese skulls rank with two others as the oldest relics of the human race. One of them is the Pithecanthropus Erectus, otherwise known as the Java man, and now regarded as valid evidence that man existed half a million years ago, and the other is the Eoanthropus, supposedly more than a million years old.

Stone Reproduction of Gingerbread House



IN the second act of the opera *Hansel and Gretel*, one sees a gingerbread house. Being impressed with this scene, Joseph Urban, a famous American designer, felt that the fairyland should be built anew. Accordingly, he designed an honest-to-goodness reproduction of the gingerbread house to be made of colored stone with a white roof that looks like cake icing, and studded with what appear to be sugar hearts. This has been erected on the estate of F. H. Bennett, at Hamburg, N. J. It is made of poured concrete and required two years to construct. It is open to children of all ages at all times.

Navy Plane Finds Swinging Perch in Skies



These three pictures show the plane before and after it hooks to the attaching device, and the details of the apparatus of attachment.

EXPERIMENTS in attaching a flying plane to a dirigible in flight have been successfully carried out with a Navy combat plane and the Navy dirigible "Los Angeles." The latter took off carrying beneath its hull a latticework structure with a single crossbar at its lower end, the bar being pivoted to rotate both fore and aft against friction. The supporting structure also has restricted fore-and-aft movement. These features permit the absorption of energy involved in the impact of the plane at a speed slightly greater than that of the airship.

The plane was equipped with an engaging hook, the tube support of which extends forward to form a partial guard for the propeller as contact is being made. An automatic locking device prevents unintentional release after contact has been completed.

In approaching for a hook-on, the plane comes in from astern in a steep climb and flies directly into the crossbar. As contact is made, the throttle is retarded. Controls are locked in neutral, the motor is idled, and the plane rides smoothly from its single point of attachment. In releasing, the pilot trips the hook and falls clear of the ship in a dive. —*Navy Dept., Bureau of Aeronautics; A. H. Gray, Comdr., U. S. N.*

Data on 92 Elements Available

INTERESTING data on the 92 elements has been published in folder form by P. C. Kullman & Company, 110-116 Nassau St., New York, and is available to any reader of this magazine. The folder, of tough paper, contains the names, atomic numbers, melting points, and years of discovery of the elements, and forms an extremely convenient reference for the scientist or student of science. The Kullman Company requests us to say that either one or two copies will be sent postpaid, gratis, to any reader on request. Professors of chemistry and chemical engineers, the communication adds, speak highly of the new folder.

Manhattan's "Underworld"

THE isle of Manhattan has a subterranean growth quite as remarkable as its growth upward, a survey reveals. In Wall Street a network of channels gives ten entrances and exits to buildings, besides the regular ones above ground. Grand Central is a prairiedog town of underground passages. A commuter working in the Public Library can follow the path to the shuttle trains, board one, and continue until he comes up on East 41st Street, directly across from his place of employment, blocks beyond it.

From Grand Central, also, passages lead to the hotels Roosevelt and Commodore—to mention but two terminals of many. The Pennsylvania Station is not far behind in the extent of its pedestrian tubes, which connect it with many stores and hostelries.

Test Shows Weight Ground Will Bear

UNDER the direction of W. S. Housel, the Department of Engineering at Michigan University has developed apparatus and methods for measuring the weight a given plot of ground will bear at different levels, before any attempt is made to erect a building. With the machinery and testing routine made available by the Housel investigation it will be possible for the engineers to compute within close limits the resistance of the ground, and to devise foundations especially suited to the conditions. Measurements can be made so precisely that the fine plaster cracks which occur in most buildings today can be avoided. The engineer equipped under the Housel plan will be able to deal with soil as a known factor, just as today he is able to deal with concrete or steel. Catastrophes resulting from weak structures thus will be avoided.—*L. W. Prakken.*

Some of the machinery devised for ground testing by the Housel research group.

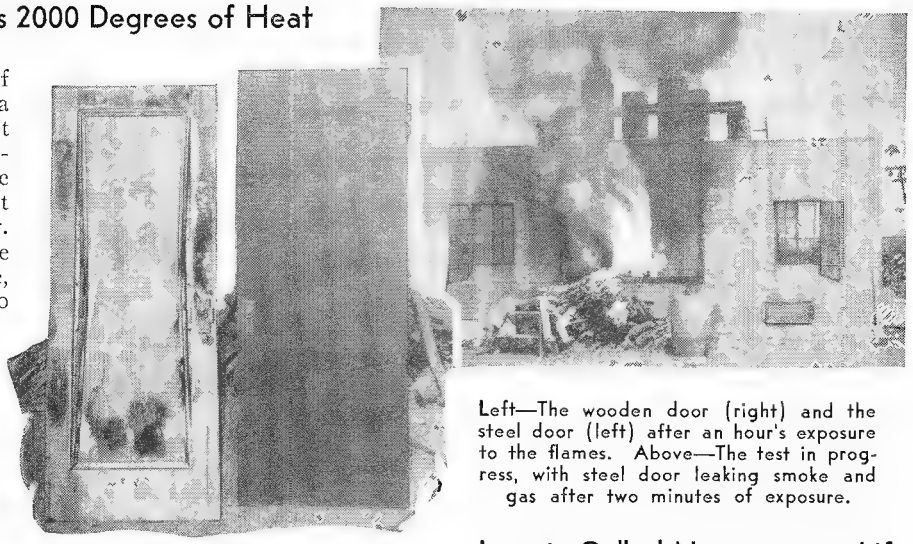
Fan, Light, and Loudspeaker Combined

A NEW piece of domestic utility apparatus for homes and hotels is now past the experimental stage and probably will be put on the market soon. It consists of an illuminating fixture containing several electric lamps, and incorporating also in its structure an electric fan and either a dynamic or magnetic speaker. The model now completed is for hotel use. When not operating, the fan is concealed by a flange in the fixture design. In action it opens by centrifugal force, and when stopped, it is brought to the concealed position by coil springs. Its diameter, open, may be 52 inches.—*J. M. Hawkins.*

The hotel model of the new combination fan, light, and loudspeaker, showing the fan in the concealed position.

Treated Wooden Door Withstands 2000 Degrees of Heat

TESTED in comparison with a door of steel, approved by fire underwriters, a wooden door chemically treated to resist heat withstood a temperature of 2000 degrees even more successfully than the metal barrier. The test was conducted at Elmhurst, L. I., by Dr. Albin H. Beyer. The two doors were placed on opposite sides of a specially constructed furnace, and the flame was applied. After two minutes the exterior of the steel door began to show the effects of smoke and gas, while the wooden door stood the fire for more than an hour without showing any exterior effects.



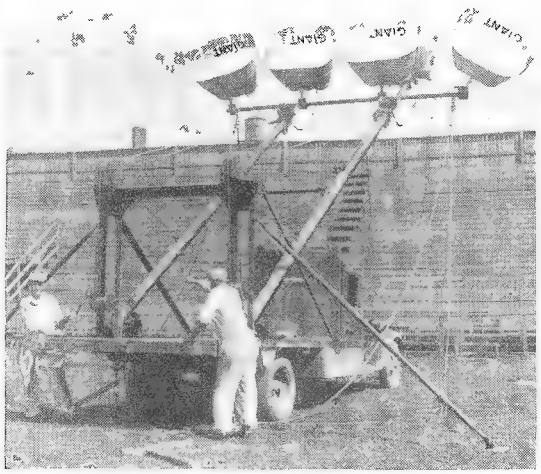
Left—The wooden door (right) and the steel door (left) after an hour's exposure to the flames. Above—The test in progress, with steel door leaking smoke and gas after two minutes of exposure.

Shows How to Step Off

WHEN you are aloft in a cabin plane at an altitude of, say, three or four miles, and wish to dismount, it is only proper that you should know the approved manner of doing so, in order that you may avoid the criticism that goes the rounds these days when a *faux pas* is made. In the picture above, Bert White pauses to demonstrate for you the pose to take just before making that long first step of—in this case—23,000 feet. It was a record.

Night Baseball Invades Chicago

A THREE-GAME series of night baseball was played recently in Chicago between the Monarchs of Kansas City and the American Giants. The former are under the management of J. L. Wilkinson, who is the originator of the apparatus for playing night baseball, as well as of the idea. For almost a quarter of a century he has been engaged in the development of the after-dark game. Some of the lighting equipment is shown in the photograph.

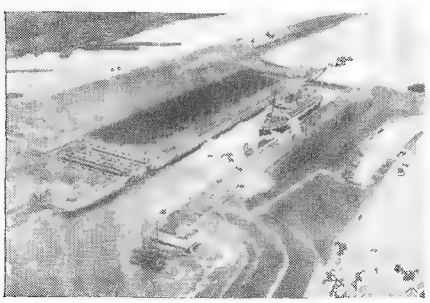


Insects Called Necessary to Life

THREE-QUARTERS of the animal kingdom is composed of insect life, declares Frank Eugene Lutz of the American Museum of Natural History. But Dr. Lutz is not of the opinion that this is something to be alarmed about. Of 15,000 species of insects within a fifty-mile radius of New York, he thinks that only about a half of one percent are injurious to man.

Dr. Lutz admits that insects destroy about twenty percent of the fruit crop each year, but says that without insects we should not be able to harvest anywhere near the amount of the other eighty percent. The reason for this is that all fruits with the exception of bananas and oranges are dependent on insects for pollenization and consequent maturity.

Largest Lock in the World



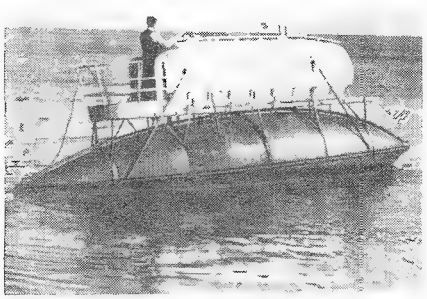
THE largest canal lock in the world has been dedicated at Ymuiden, Holland. It gives access to the North Sea Canal and connects Amsterdam with the outside world. It is 400 meters long and is able to transfer a 100,000-ton ship.

Automatic Doughboys Next?

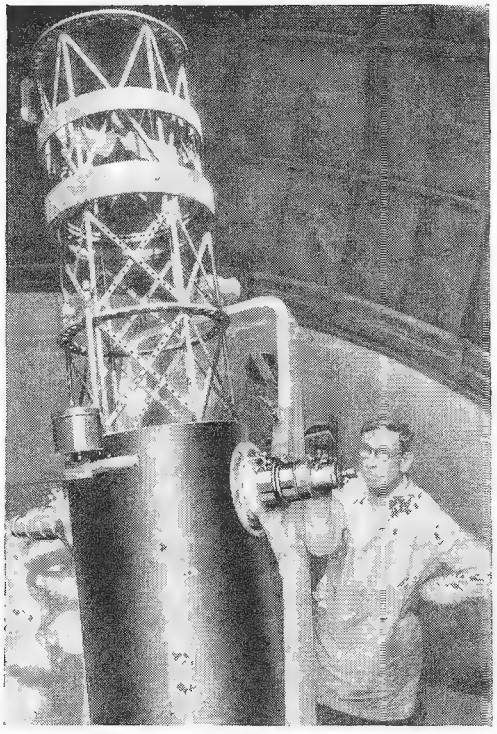
THE infantry will be equipped with automatic rifles in the coming war, according to observers of the work of the Ordnance Division of the Army, and will carry a pack of only forty pounds when they hop aboard the trucks which (we hope) will be on hand to save their dainty hobbed shoes. And on the way out of the cantonment they'll keep step with the music of an automatic band unit, mounted compactly on a motorized vehicle. At least we know they have the automatic band. It was tried out last spring for the first time by the Third Battalion of the Twelfth Infantry, Fort Washington, Maryland.

Unsinkable Boat for Trans-oceanic Passage

AN engineer and inventor named Sigg, resident in Berlin, has completed the first specimen of a new type of boat which he says is unsinkable, and with which he intends to cross the Atlantic. Viewed during its first test on the Bodensee, the Sigg craft appeared as a torpedo-shaped body of steel, topped by a watertight



cabin in which the operator can ride out rough weather. The craft is powered by an internal combustion motor.



Working Miniature of Mount Wilson Telescope

AFTER grinding his own 28-inch mirror, Dr. George Ferguson, of Los Angeles, duplicated the famous 100-inch Mount Wilson telescope. Each piece in this construction is on a one-fifth scale. The telescope is mounted in an observatory in the back yard of Dr. Ferguson's home. Considering its size, the telescope gives remarkable results.

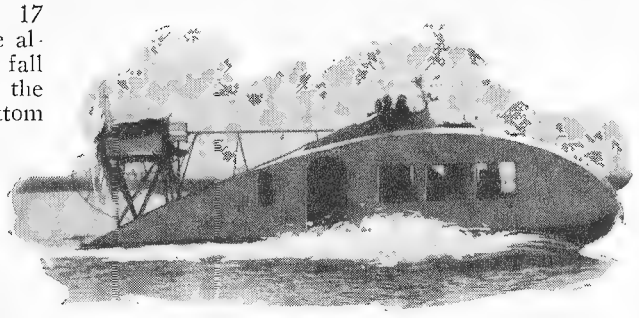
Amateur telescopes have been made in all forms and sizes. One of the simplest of amateur telescopes of the reflecting type consists of an ordinary piece of wood with a mirror held at right angles to the wood strip, and with a prism and eye piece at the opposite end. The telescope is light and easily mounted or demounted. Full details of the construction of telescopes of various types and sizes have appeared in back issues of this publication.

Pure Liquid Water Below Zero

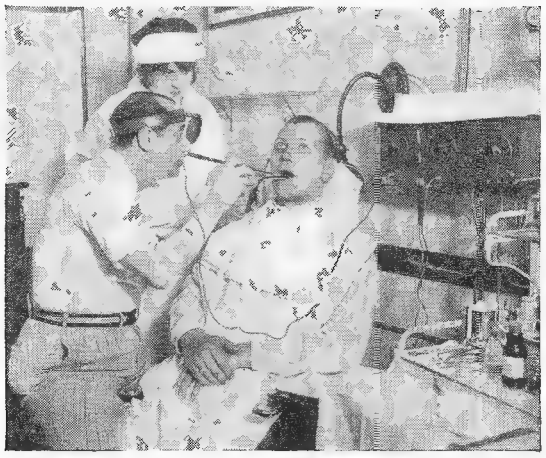
IT is not generally known that pure water can be reduced in temperature below zero degree Centigrade, and still not freeze. An English experimenter, Prof. L. Hawkes, of Bedford College, London, cooled a small vessel to minus 17 degrees Centigrade. He allowed drops of water to fall into this, and when the drops struck the bottom they were as hard as bullets, but showed none of the crystalline form of true ice. Water can be super-cooled to a temperature of 6 or 7 degrees below zero, and if kept absolutely still the water will not solidify. A slight disturbance and the glass of water becomes a cake of ice. The reason that the super-cool liquid does not freeze is because the water is pure and the sides of the glass are smooth.

Streamlined Propeller-Driven Boats

GERMANY is evidently making rapid strides in the field of transportation. The Graf Zeppelin, the Bremen, the Europa, and the Dornierwahl are outstanding examples. At present, the country is engaged in developing a speedy means of transport on inland waterways. Engineer Ellinghausen has developed an air-propelled gliding boat that is being tested and that may be the forerunner of a whole series.



Removing Tonsils by Radio



THE apparatus that looks like a radio set is employed for the purpose of removing tonsils. It is a modern version of the radio knife that was described in this publication in detail when it first appeared on the market. The system of tonsil removal in this fashion is supposedly achieved by dehydration. It is painless and bloodless, and the patient can usually eat immediately after the operation. The photograph shows Dr. Millstone, of Chicago, Ill., removing the tonsils of Joe Sanders, songbird.

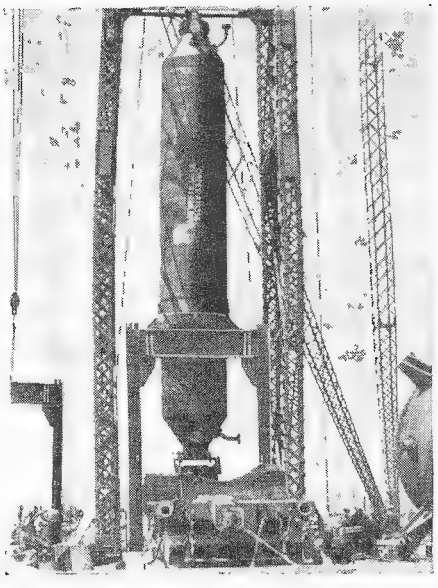
To Cross the Ocean in a Rubber Ball

TWO Brooklyn mechanics, Carl Herzog and Fritz Vogel were lying on the shore at Rockaway Beach, Long Island, when a balloon fell in the water. As the wind caught it, the balloon was carried out. Both men, of German birth, who saw service in the World War, began to discuss a plan for building a large ball that would be able to cross the ocean.

In a letter made public by the United States Rubber Specialty Company, of Trenton, N. J., the plans of these men are aired. The ball anticipated is to have a diameter of 15 feet, and to be made of ¼ to 5/16 inch material with an opening at the top about 30 inches in diameter. The two men are to take care of the inside equipment, and expect to meet expenses by selling pictures of the ball in Europe and America. The bottom of the ball is to be ballasted, and the inside is to contain slats for the storage of fuel and for the support of the rubber. The ball will not be provided with a sail, the surface exposed to the wind is to act as its own sail. The men expect that the trip will take about sixty days, but will make provision for a total of ninety days. Naturally, such a ball will be at the complete mercy of the winds, tides and water currents.

Placing 123-Ton Soaking Tube in 9 Minutes

BY means of special machinery made for this very purpose, a gigantic soaking tube weighing 123 tons was placed in exactly 9 minutes. This tube is part of the $750,000 extension of the Imperial Oil Company's plant at Imperoyal. The machinery that was used to place it can be moved from place to place for like installations. The soaking tube is 5 feet in diameter and 125 feet long. Its steel sides are capable of withstanding a pressure of 1,000 pounds to the square inch.



Matching Colors by Machinery

DURING the past few months, this publication has repeatedly portrayed the new strides being rapidly taken by physicists who have invaded the field of optics and have relegated to a laboratory the special functions that heretofore were left entirely to the human eye, namely, the matching of colors. At a demonstration given to the public and before members of the New York Electrical Society, Dr. H. H. Sheldon, Professor of Physics at Washington Square College University, and his assistant W. A. Schneider, Associate Professor of Physics at the same school, demonstrated the possible applications of this instrument, which plays a part in all branches of work in which color is used.

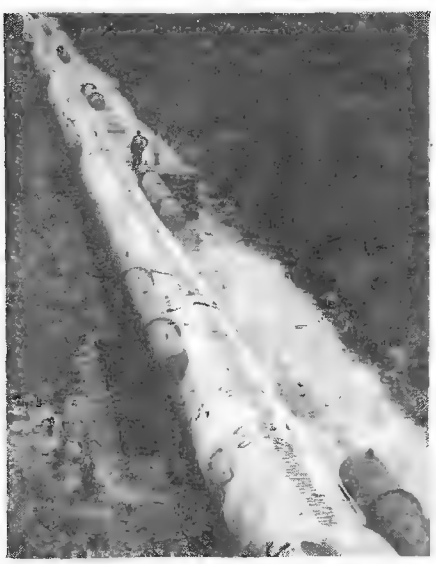
The principle of the colorscope, so named in order to distinguish it from other forms of apparatus used only for color analysis, is based on the photo-electric cell. In this particular apparatus, two photo-electric cells are used to create a balanced circuit under a normal light source. They are connected to a galvanometer in such a manner that when both receive the same amount of light, the needle of the galvanometer remains at zero. If one or the other cell receives more light, the change in current causes the needle to deflect to the side registering the heaviest radiations.

Weave and sheen effects are taken into consideration by employing rotation or by counteracting the sheen through an intergrading sphere.

Right—Dr. William A. Schneider, seated, operating the tuning dial to bring the galvanometer needle to zero before demonstrating how colors are matched in a laboratory model of the colorscope. Dr. H. H. Sheldon standing on the platform.

Left—Checking pieces of apparently matched paper in the commercial model of the colorscope with Drs. H. H. Sheldon and W. A. Schneider at the instrument.

The Tube That Was Lost

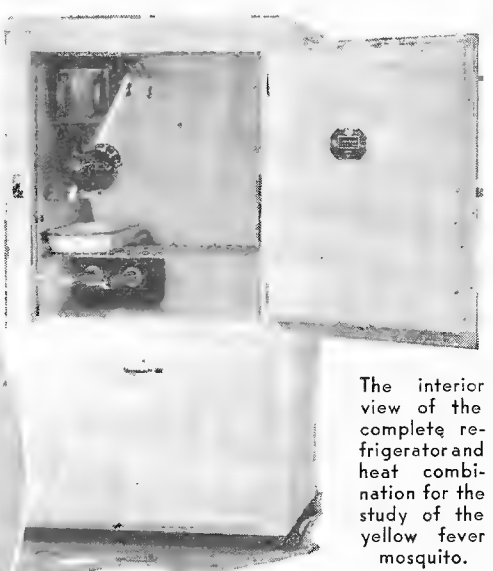


A GIANT tube said to have cost merely $1,000,000, made of corrugated steel, weighing 300 tons and more than a mile and a quarter in length, was lost in 550 feet of sea during an attempt to lay the pipe on the sea bottom. The readers of this publication know that Prof. Georges Claude, famous French scientist and pioneer in the research of rare gases and the liquefaction of air, had contemplated building an electric power station utilizing the differences in temperature of sea water. This steel pipe especially insulated was to supply the cold water from water at a depth of 600 fathoms, which has a temperature of about 37 degrees.

Combination Heater or Refrigerator for Germs

SCIENCE is paying more attention to microscopic germs and even developing unusual pieces of equipment for the proper cultivation and propagation of these very often dangerous micro-organisms.

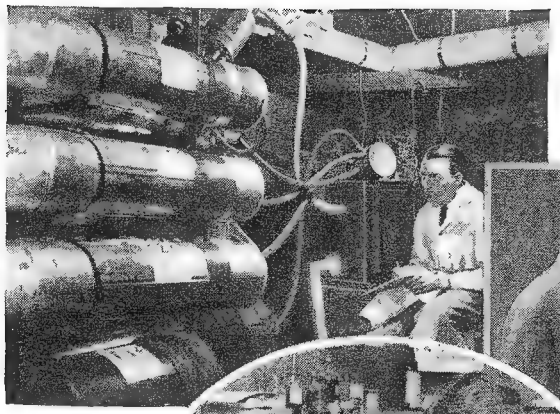
Here is an adaptation of a common household type of electric refrigerator made expressly for bacteriological incubation purposes that may be of interest to hospitals, clinics and laboratories. The first one of these instruments has been obtained for the Rockefeller Foundation Laboratory, at Bahia, Brazil, where it will be used for the study of the mosquito which carries the dreaded yellow fever. The customary cooling coil of the refrigerator has been replaced with a much smaller unit that permits of attaining low temperatures without causing excessive frosting. In addition, the cabinet has a thermostat by which predetermined temperatures are obtained.



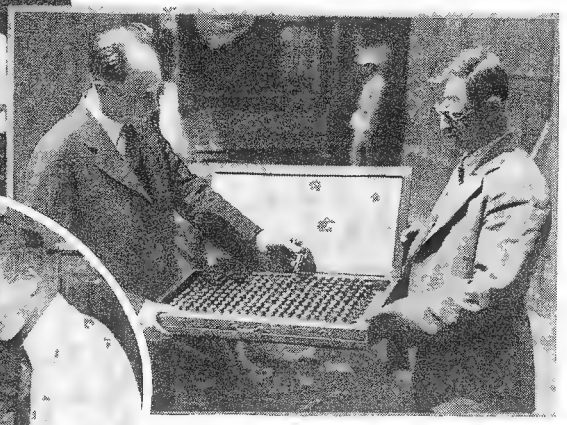
The interior view of the complete refrigerator and heat combination for the study of the yellow fever mosquito.

The compartment in which the mosquito cages are to be placed is eighteen inches high, thirteen inches wide and eighteen inches deep. With this cabinet, scientists expect to determine the temperatures that accelerate or retard growth and development of the yellow fever mosquitoes. Photo shows heating and refrigerating coils.

Scientists Raise Corn Borers, Then Trap Them by Odors



Left — Kenneth Bartlett making readings on the olfactometer, an instrument used to find the odor which will attract the corn borer moth.



Laurence O. Johannsen feeding corn borer larvae in small glass bottles.

Above—C. H. Batchelder and Francis L. Prendergast with a case of odors made from various parts of corn stalks used in studying methods of eliminating the borer.

THE Government Laboratory, at Arlington, Mass., is actively engaged in developing a means for the destruction of the corn borer. This assumes several different angles of approach. It has been found that five odors made directly from various parts of corn stalks will attract the corn borer moth, but 900 other odors, also made from corn, do not attract it. To determine which odors attract, a drop of the odor is placed on a piece of blotting paper and put into an olfactometer. The moth is also placed in another section, and if attracted by the odor, it will make toward the direction from which the odor comes. Four million corn borers are being raised at this station to determine what parasites will prey upon them. These borers receive food every four or five days, and are kept in bottles.

Was Radium Responsible for Evolution?

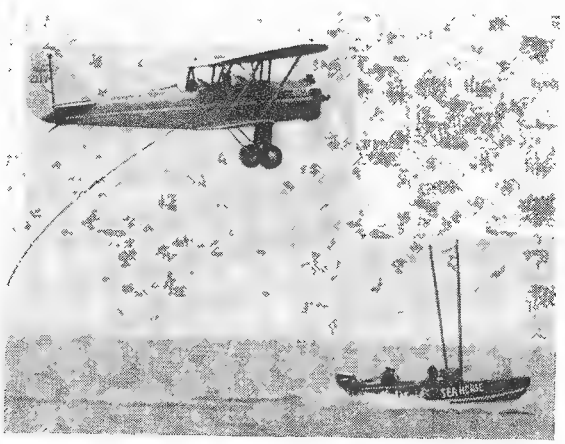
EVIDENCES of evolution are reduced from a period of centuries to a relatively few weeks in the laboratory of Dr. T. H. Goodspeed at the University of California. Dr. Goodspeed believes that the earth's natural radium emanations may have helped to create new species, and has obtained some remarkable results.

At this laboratory, changes in plants which might require from 100 to 10,000 years, are made in one season. X-rays and radium are employed. Dr. Goodspeed has taken ordinary commercial tobacco seed and raised tobacco plants from this seed. The seed was exposed to radium or X-rays a short time before planting. Some of the resulting plants are dwarfs, others are giants. Some are short and thick, others tall and slender. On occasion, Dr. Goodspeed was able to obtain plants that had their leaves inverted. The bottom side of the leaf was facing upward.

By way of explanation, it is believed that the rays less than a millionth of an inch long penetrate into the nucleus of the body cells and rearrange the nuclear material. With this change in pattern, the startling differences in the nature of the plants result. The nuclei carry all the inherited characteristics of not only plants, but also of animals and men. Up to the present time, it has been quite impossible to control the ultimate outcome or to predict the end of any treated seed.

The process of evolution once regarded as going on in accordance with well-defined influences, often has shown a tendency to sudden mutation.

Picking Up Mail from Airplane with Outboard Motorboat



A DEMONSTRATION of the new Elliott airmail pickup was recently held on the Detroit River at Detroit, Mich., and proved highly satisfactory. The purpose of the new device is to enable an airmail pilot to pick up mail from small communities *en route* without making a landing. A regulation mail bag is suspended between two uprights that are mounted on a boat driven by an outboard motor. This boat then sets out along a straight course and waits until the mail plane pilot can swoop down and allow his trailing pickup to lift the mail bag from the outboard motorboat.

Hearing Through the Fingertips

IT has been discovered that while the human ear is from ten to sixty times better than a fingertip in distinguishing the pitch of a tone, it is no better at all in telling how soft or loud the tone is than the fingertip. This discovery was the result of researches on a possibility of hearing sounds with the fingertips made by Prof. R. H. Gault, of Northwestern University. The researches are directed toward the possibility of enabling deaf persons to hear by pressing the fingers against a vibrating member and permitting the sense of touch to convey vibrations to the brain.

Egg Weighing and Selecting Machine

A REMARKABLE machine is being demonstrated at the Great Dresden Hygiene Exhibition, which selects the good from the indifferent eggs, and automatically stamps them according to weight, size and quality. The machine is here shown in operation.

Modern Electric Lamp Is Laboratory of Chemicals

A MODERN incandescent bulb, according to Current Science, is a veritable laboratory of chemicals. The glass is made of sand, soda and lime; other substances may be added. Manganese and arsenic make it colorless.

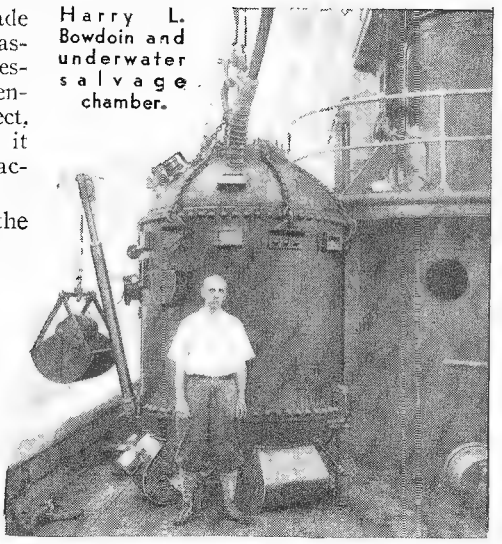
The tungsten used for the filament is made from Chinese ore. It is fused with caustic potash to form potassium tungstate, and then treated with hydrochloric acid to give tungstic acid. This is ignited in hydrogen, giving metallic tungsten. This is pressed in a mold, baked, and heated to white heat by an electric current. When the metal is near the melting point, it is machine-forged into a bar, while in an atmosphere of hydrogen to prevent oxidation. The bar is then passed through holes that are successively smaller, first in steel dies and then in diamond dies, until the wire is so fine that it must be weighed to determine its diameter. Lengths of wire are then cut for insertion in lamps. A 25-watt lamp has 20.3 inches of filament. The temperature of the filaments approaches 3,000 degrees centigrade in use. The thicker wires that hold a filament in place are tungsten or molybdenum. The wires that pass through the glass in the sealed stem are a compound of iron and nickel that have substantially the same coefficient of expansion as glass. Thus the wire and glass expand equally. The bulb is set in a brass base. The wires are soldered with an alloy of lead and tin, and the cement that fastens the base to the glass contains alcohol, marble dust, pine resin, shellac, chalk, bakelite, glyptol and malachite green.

New Salvaging Chamber to Seek Sunken Treasures

MANY have been the attempts made by inventors to regain the treasures that have become the possessions of Father Neptune. Most inventors have grandiose ideas on the subject, but seem to fail miserably when it comes to putting the ideas into practice.

We wonder what the outcome of the invention of Harry L. Bowdoin will be. This Saybrook, Connecticut, inventor has perfected an underwater robot which he and his friends are at present testing and with which it is expected to retrieve some of the millions in treasure and material that have been sunk beneath the surface of the seas.

The device consists of a large enclosed diving bell in which the operator sits. The bell is equipped with suitable devices to permit of its propulsion on the floor of the ocean. The bell has a grabber-bucket suspended from a boom that can be operated from the interior and that will be used to remove the treasure.

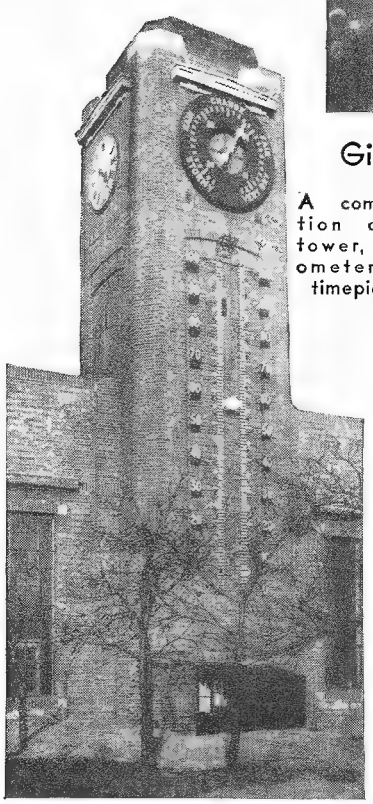


Harry L. Bowdoin and underwater salvage chamber.

Blow Yourself a World

Miss Howard is blowing up the world while B. J. Wyle looks on.

A NOVEL innovation, shown for the first time at the annual convention of the American Library Association at Los Angeles, California, is a rubber balloon on which is printed a map of the world. The educational feature is an invention of B. J. Wyle, who believes that the item should be a great aid to geography teachers. We take it the students will be instructed not to point out the location of any country with a sharp pencil or pin; otherwise the world might burst.



A combination clock tower, barometer and timepiece.

Giant Barometer and Thermometer in Clock Tower

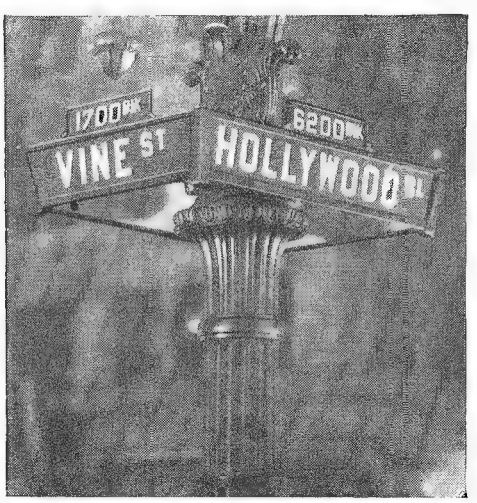
ON a tower belonging to the Cherry Blossom Boat Polish Co., at Chiswicken, England, a clock has been erected in combination with a monster barometer that indicates the probable weather changes and a thermometer that runs up the side of the tower. The temperature can be read at a great distance. The degrees are indicated by numerals on either side, and a diamond-shaped indicator moves up and down to show the outside temperature.

Fire Boats Directed by Radio Phone

EXPERIMENTS with the fire boat *John Purroy Mitchel*, which has been equipped with a radio telephone communication apparatus to link it with its berth at the Battery, indicate an annual saving in time and a saving in cost amounting to thousands of dollars by calling back the boat from useless runs.

Signs Illuminated by Day and Night

SIGNS that utilize the sun's rays by day and the light from already installed electric lights by night, and that are illuminated by both day and night were invented and patented by H. J. Palmer of Los Angeles, California.



A Fireproof Airmail Bag

A MAIL BAG made of fireproof material was tested at the Municipal Airport, Chicago, in the presence of post-office, bank and express company officials with a view to using containers of this type in the regular airmail service. The bag was filled with papers, in the presence of officials, sealed and placed in the center of a pile of rubbish saturated with gasoline. The combustible pile was then ignited. The blaze burned with an intense heat for approximately fifteen minutes, and then died out. After the mail bag was opened, it was found that the contents was in no way injured. The oval picture shows the blaze at its height. The one at the left shows the contents being examined after the blaze.

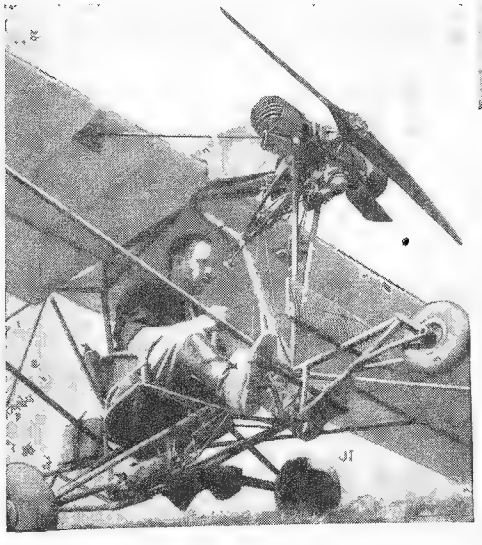
Officials examining contents of the bag after the flame test. Left to Right: W. D. Goddard, Johns-Manville Corporation; J. A. Behrendt, First National Bank of Chicago; P. H. Cummings, Railways Express Agency; B. F. Myers, Post-office Air Service.

Peculiar Method of Predicting Sand Storms

A REPORT would have it that three scientists have discovered a means of warning tribesmen, troops and voyagers of the approach of a sand storm in ample time for them to seek shelter. These men erected an instrument which they called an atmo-radiograph, and which is intended to indicate the movements of flying insect hordes through the desert air. The instrument is connected with a distant station by telephone. One day while listening in for insects, they heard a tapping noise which investigation revealed was a sand storm rising on the desert. A specially designed instrument was then built for the purpose of indicating such storms.

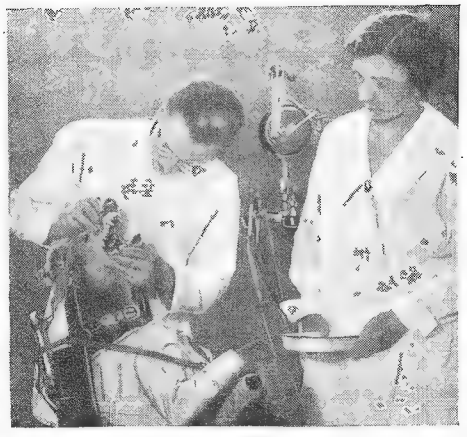
Learning to Fly Without Leaving the Ground

LEARNING to fly by the trial-and-error method is the novel system, developed by H. S. Myres and P. D. Smith of Los Angeles. The method consists of equipping a glider having small wing surfaces with a small motor and propeller. The glider will respond to all controls but it cannot leave the ground.



A Day in a Dog's Life

MOST of us suppose that the teeth of a dog are just too doggone good to require the services of a dentist. But even the dogs find that civilization has a disastrous effect on their teeth. What, with dog biscuits and the other kinds of puppy food, who could expect a dog to have good sharp teeth? And so in Washington, D. C., we find the first dentist for these four-footed animals in the person of Dr. Clyde A. Basehoar, who is being assisted by Miss Drake while operating on his first patient.



Lifesavers for Aircraft

Helen Eckerson getting ready to snap parachute to ring on the vest.

TEN seconds after the passengers on air transports are warned to leave the ship, in event of midair emergency, they will be able to float earthward, thanks to a new type of detachable parachute. This device was designed by engineers of the Russell Lobe Parachute Corporation. The parachute is a part of the equipment of the plane, and the passengers are required to wear a special vest of light fabric. In event of emergency the passengers reach up, grasp the 'chutes, snap the hooks to the rings on their vests and leap out of the plane.

Another Cancer Cure?

THE value of mustard gas as a preventive of induced cancer in rats and mice was explained by Prof. R. D. Passey of the University of Leeds, in a lecture given before the British Empire Cancer Campaign Organization at London, England. Mustard gas, as everyone knows, is the dreaded poison gas that was used so effectively in the World War. It was found that rats and mice contracted cancer when tar was applied to their bodies, but it was also discovered that if mustard gas was first applied to the skin before the tar was daubed on, the tar did not induce cancer. It seems likely that another peacetime use for a war gas has been discovered, and it was predicted that science will ultimately be victorious over cancer. It would be interesting to determine whether any of the men in the outfit "over there," who had been gassed by mustard gas have developed cancer. It is not thought likely that tar is the causative agent of cancer, because cancer will develop in areas where tar can never be applied. It is to be distinctly understood that this cancer treatment is purely in the experimental stage, and should not today be considered as a means of treatment for this condition. Cancer experts are awaiting with an intense degree of interest further details regarding this development.

A Lathe of Wood

By E. Carlyle Lynch II. *

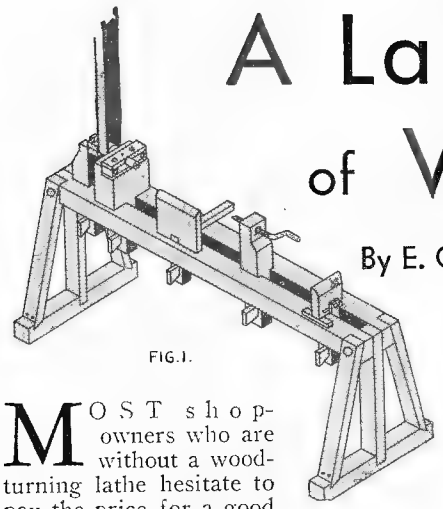
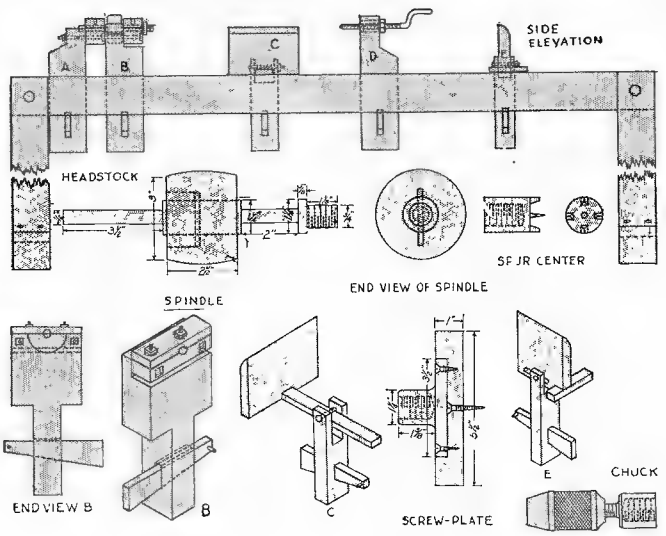


FIG. 1.

Here is a lathe that will perform excellently, though made entirely of wood. It can be built for from $4.00 to $6.00.



MOST shop-owners who are without a wood-turning lathe hesitate to pay the price for a good one simply to experiment or learn on. It is for such shop enthusiasts that this article has been prepared; the lathe shown in the isometric drawing may be built for from four to six dollars.

The bed of the machine is made from a well-selected piece of "four-by-four" (3½ inches x 3½ inches stock size) twelve feet long, cut in half, giving a bed 6 feet long. The bed pieces are cut out at each end to receive the slanting legs. Likewise the piece the legs fit into at the bottom—the floor rest—is cut as shown; this piece should be about 3½ feet long. The bottom of the slanting legs are mortised and screwed into this piece.

The middle leg at each end is a piece of "two-by-four" (1½ inches x 3½ inches approximately) that should come up to about 7 inches below the operator's belt. A carriage or machine bolt ⅝ inch by 9½ inches is required to hold the bed pieces and legs together at the ends. The middle legs are screwed into their mortises in the floor-rest from beneath.

The front part of the headstock, B, in Figures 2 and 3 is made from a piece 3½ inches by 5½ inches (commonly "four-by-six") cut as illustrated. The top of B should be cut square 6 inches above the shoulders, and a half-round piece cut out of the top to allow for the pulley, (see end view of B). The extension or neck of B extends down from the shoulders 8 inches and is wide enough to fit snugly the space between the bed pieces—about 1½ inches wide. As will be seen in Figure 2 the mortise for the wedge of all the parts is cut a little higher than the bottom edge of the bed to insure a strong wedge-grip.

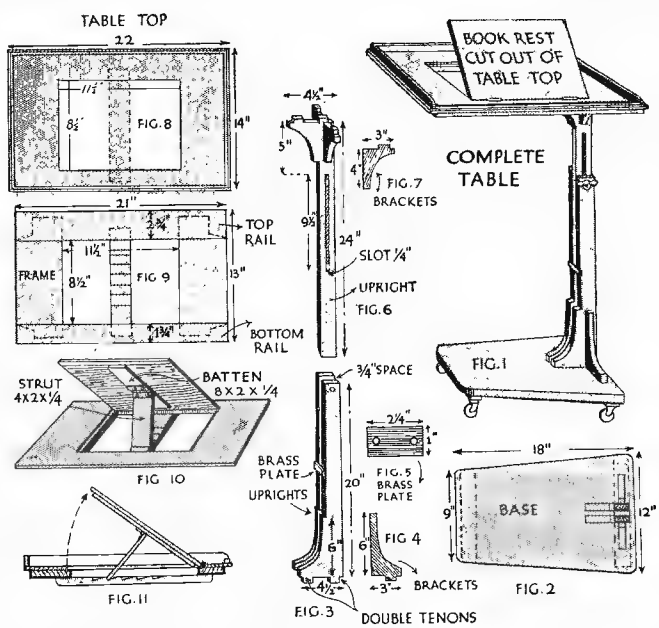
The back of the headstock, A, is made similarly to B; it is cut from a piece of four-by-four. A small slot is cut out in the top for the end of the spindle, see Figure 2.

The bearings (*Continued on page* 542)

A Combination Bedside Table and Bookrest

By J. E. Lovett

A TABLE of this kind is invaluable in the home, as it may be used for many purposes. Not only can it be employed for serving a meal to those confined in bed, but it is fitted with a book rest so that it can be used for reading. The height of the table is adjustable, allowing its use with a bed, settee or chair. The book rest is also adjustable. The base is solid and fitted with four casters. Two uprights are framed into the base, and another upright which carries the table top fits between them and is adjusted to the required height with a bolt and thumbscrew. The table top is framed and panelled, and the book rest is made to fall flat when not required, giving a level table top. Oak is the most suitable wood to use. Referring now to the details, the base indicated in Figure 2 is 18 inches long and 12 inches wide at one end, and tapers to a 9-inch width at the opposite end. The wood is ¾ inch thick, and is strengthened with two battens 1½ inches wide and ¾ inch thick, positioned as indicated by the dotted lines. The two uprights given in Figure 3 are framed into the base and are 20 inches long by 4½ inches wide at the bottom, and are shaped substantially as the diagram suggests to 1½ inches at the top. The wood is ¾ inch thick. Double tenons are cut at the bottom ends and corresponding mortises are cut in the base. The uprights are spaced ¾ of an inch apart.



The work is strengthened by fixing brackets suggested in Figure 4 on each side of the uprights. The brackets are screwed through the uprights before the latter are fixed, and tenoned into the base. Two small brass plates, the dimensions of which are shown in Figure 5, are screwed at the front and back of the uprights, as shown in Figures 1 and 3.

The upright suggested in Figure 6, which carries the table top, is 24 inches long by 4½ inches wide at the top, shaped to 1½ inches at the bottom by ¾ of an inch thick. Brackets made as in Figure 7 are fixed to each side or, if desired, three such brackets can be mounted on the upright to produce substantially the same effect as shown in the illustration. A ¼ inch bolt and thumbscrew is fitted at the top of the two bottom uprights and slides in the slot that is cut in the top upright.

The table (*Continued on page* 569)

* 2nd Prize Winner in July Handicraft Contest.

Second Prize—$60.00

Mrs. R. E. Buser

Mount Morris, Illinois

Basement Improvement

Last Month the Winners of Our Prize Contest Were Announced, Was Printed, with the Plan —Below You Will Find the Plans Second and Third Prizes, Either an Inspiring Example of Basement in Your

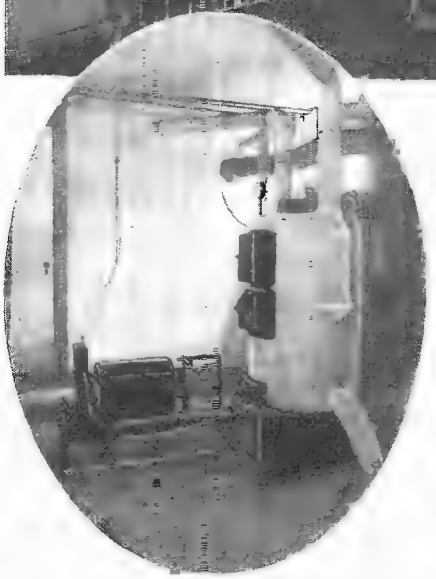
Getting the Most Out of a Basement

By Mrs. R. E. Buser

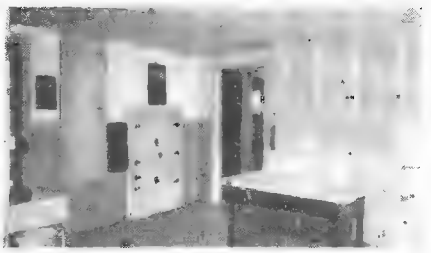
Second Prize Winner

Upper Left—The well-lighted breakfast nook in the Buser basement.

Above—Dining-room with built-in buffet, one of the features adding to compactness.



Above—**The** oil-burner installation is compact, simple, clean. . . . It eliminates coal-bins and thus saves space, and does away with dirt and **drudgery.** It is a big factor in the livable basement.

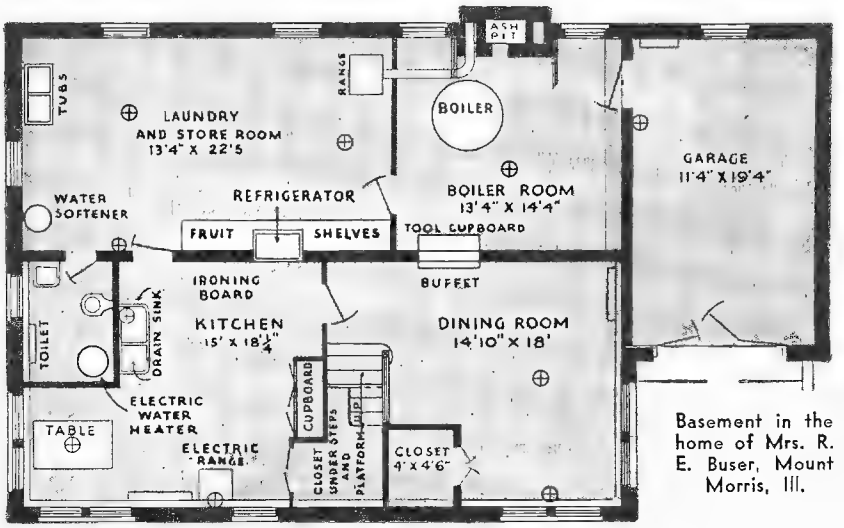


Above—The Buser basement kitchen, showing built-in refrigerator and ironing board (at left of refrigerator).

Below—An exterior view of the finely designed Buser home.

WHEN we were planning to build a new home, our first idea was to get as many conveniences as possible for the money. Having already seen and liked a little home built on the order of the one I am about to describe, we began to work out a plan to incorporate those ideas into our home.

We wanted a large living-room, sun parlor, three bedrooms, bath, kitchen, dining-room, and garage. To build a bungalow composed of rooms of the size we wished would have required much excavation and concrete work and many squares of roofing which in turn would have given much useless space in basement and a big expense for roofing. To eliminate this large excavated and roofed area, we planned to put our dining-room, kitchen and garage in the basement on the sunny side and the laundry and furnace room on the north side, with (*Continued on page* 539)



Basement in the home of Mrs. R. E. Buser, Mount Morris, Ill.

At the right is a general plan of the basement awarded Second Prize in the S. and I. Contest. . . . Note that the use of oil heat gives extra room, not to emphasize the freedom from dust, ashes, and drudgery. Note, too, that the tool cupboard in the boiler room is built in combination with the structure of the buffet, and occupies with it a recess extending completely through the wall between the dining and boiler rooms. The electric water heaters conveniently supply hot water when the weather is too warm for the oil burner to be used. The ash pit serves for incineration purposes.

¶ A Comprehensive List of Building Material Manufacturers Literature May Be Found in

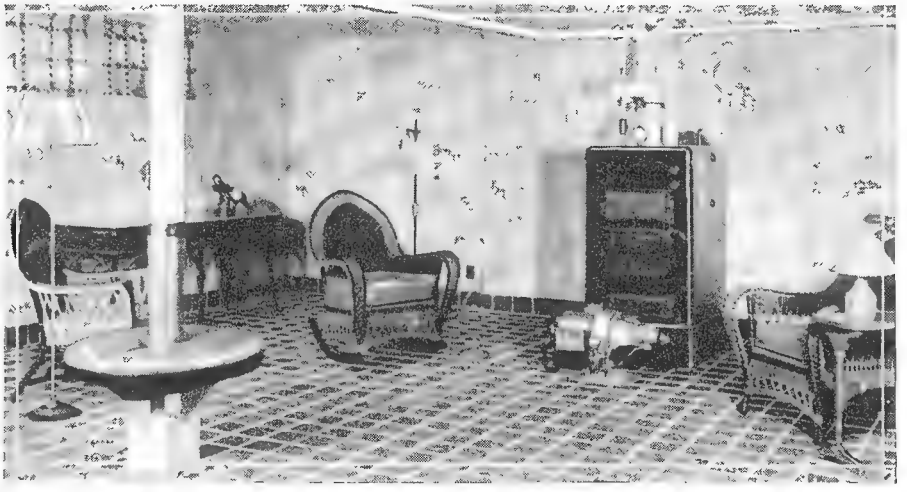
Plan Prize Awards

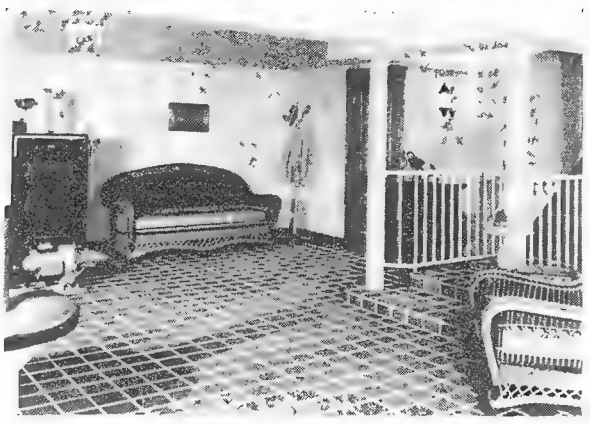
Third Prize—$40.00
A. P. Kane
Bloomington, Illinois

Basement Improvement Plan and a Review of the Contest which Won the First Prize Award Submitted by the Winners of of which May Furnish You with Utilization that You May Apply Own Home.

We Made the Basement Part of Our Home

By A. P. Kane
Third Prize Winner





The oil burner fits neatly into the scheme of the Kane basement living-room. Note how the column is made to serve a living-room purpose by supporting an upholstered seat.

Above—With rails and an ingenious arrangement of the steps, the two columns shown here are incorporated in the living-room scheme. The impression is one of comfort, spaciousness, and good taste.

Right—Exterior of the Kane home.

WHEN the plans for my new home were drawn up, Semi-English architecture and Oil-O-Matic heat were specified. This meant the elimination of fuel storage bins with available space to be utilized in some practical manner as an integral part of the home.

Concrete blocks formed the walls, and rafters were visible. Waterproof cement had been used on the outside and protected the basement from that dampness which is all too common in this part of the home. As it stood, the basement was bright and clean enough, but at the best it could serve as nothing more than a good storage space combined with laundry room. It simply did not fit in with the rest of the home.

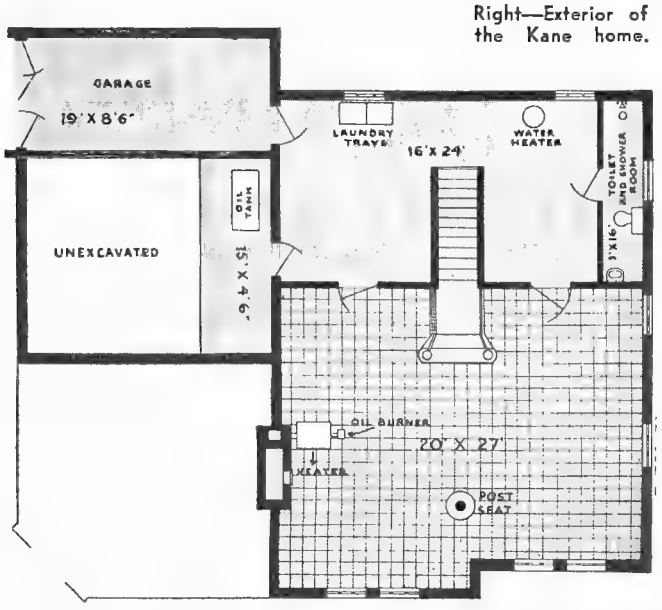
Discussion and planning finally conceived a basement which would prove thoroughly practical and also be a vital part of the livable home.

First, waterproof cement was used on the inside walls, giving two-fold protection against dampness. Ceiling rafters were covered with standard insulation material. Then side walls and ceiling were given a coating of plaster which resulted in a finished surface identical to that obtained upstairs.

Six-inch red tile was used in laying a floor which is attractive, easily cleaned, and will last for years. Instead of concealing the heating plant it was so arranged that it has proved to be one of the highlights of the entire decorative scheme. A red-jacket boiler was chosen. To match this the oil burner was painted the same color, with all fittings chromium-plated. This heating plant set the color combination for all furnishings used in the basement, since red and black are employed throughout.

One of the first problems with which we had to contend was the camouflaging of three supporting posts. When one came to the steps into the basement, two of these met the eye immediately. These were taken care of by building the stair landing out to them, blending them with the room in an attractive manner. A circular seat covered with an overstuffed cushion was built around the single post.

The main basement room comprises about (*Continued on page* 543)



The general plan of the Kane basement utilization is indicated in this drawing. Note the large space, wasted in old designs, added to the livable portion of the house. A toilet and shower room has been made available at a convenient point. An automatic water heater is part of the equipment. . . . Waterproof cement on the inside walls provides protection against dampness, and the rafters are covered with standard insulation material.

the April, May, June, and September Numbers of "Science and Invention" (See page 558)

Metals that Grow

By Dr. Ernest Bade

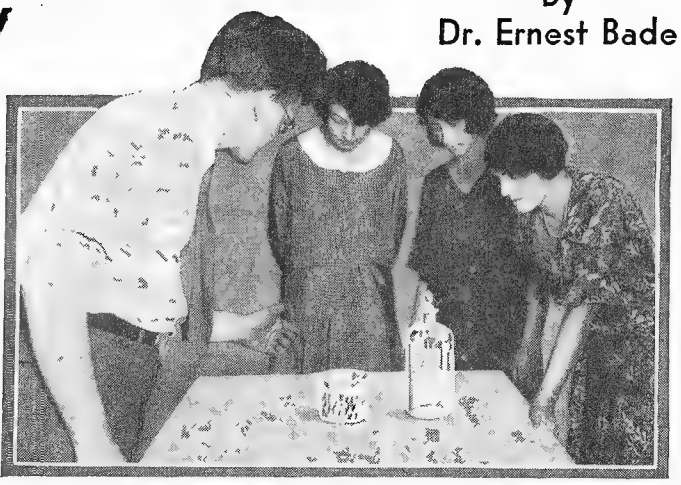
You Can Grow Tin, Lead and Silver Trees in Your Own Laboratory and Learn Something About the Displacement Series of Metals

THE growth of metal "tree" forms, although of secondary importance, is interesting and fascinating to watch. The process leads back to the displacement series also known as the electro-motive series. This is a list of metals arranged in such a way in a table that any element in the list will displace from its salt any one following it: Potassium, sodium, calcium, magnesium, aluminum, zinc, iron, nickel, tin, lead, hydrogen, copper, mercury, silver, platinum, gold.

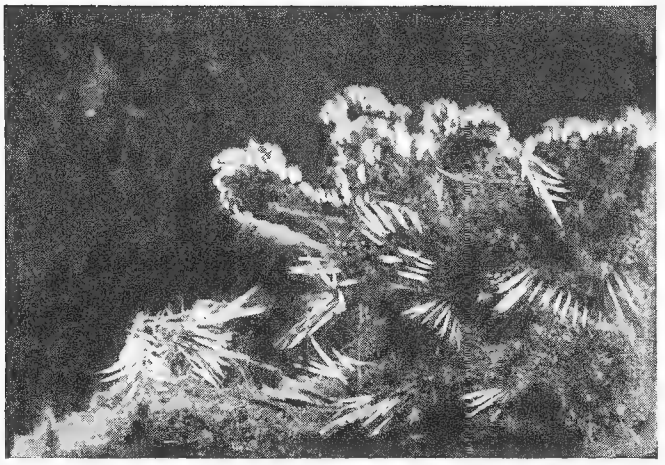
All the metals above hydrogen will develop hydrogen from solutions of its salt. If any action does take place it must be preceded by the reaction known as oxidation.

To make trees of some metals it is best to use special salt solutions, as some compounds give better results than others. The simplest of all metal trees to make is the silver tree. Make a strong but not concentrated solution of silver nitrate in distilled water, place a rather large drop of mercury in the beaker or other container in which the tree is to grow, and pour the silver nitrate solution into the vessel. The tree will "sprout" from the mercury. Here, as the displacement series shows, mercury is displacing silver from the silver salt and mercury is going into solution.

The growth of all these metal trees is rather slow and the growth itself quite delicate. It is for this reason that the vessel in which they are grown should be placed on a shelf where they cannot be readily disturbed, but where the reaction can be very closely followed. The silver sprout at first resembles a growth like moss which, as time goes on, develops into a dense shrub which soon grows bigger and then forms many branches. If a few drops of nitric acid are added to the silver solution, the moss-like growth develops rapidly, but the acid present annihilates the growth almost instantly.



Demonstrating the mysterious growth of a lead tree.



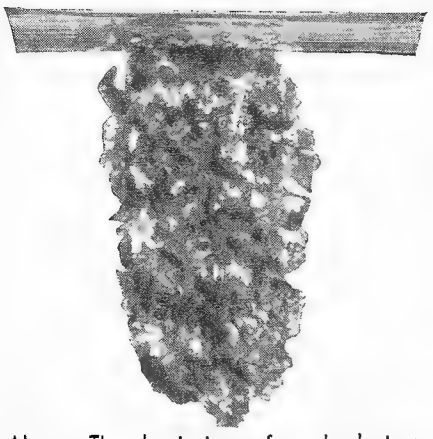
Here is a metal growth. It is a silver forest, grown from silver nitrate and is one of the simplest growths to contrive.

That is, the silver grows to a certain height, and then it is gone as if in a flash. It is really weird to watch the development and then the destruction of the silver moss.

Lead salts also produce a growth when a zinc rod is suspended in the solution. The lead is precipitated on the zinc in the form of thin plates either until the zinc is all dissolved or until the lead in the solution is exhausted. A solution well adapted for this growth is lead acetate, which is dissolved in water.

The action of these metallic tree-like growths may properly be considered as an electro-chemical one. The salt in the solution deposits its metal on the metal placed in it, while the metal placed in the salt solution slowly dissolves to replace the metal taken out of solution. Here a kind of battery is formed, something like a concentration battery where the salt gives the concentrated solution, while the metal, by the displacement of this metal, gives a very dilute solution.

Since the formation of the tree is very slow, a small quantity of acid, nitric acid for (*Continued on page* 567)



Above—The beginning of a lead tree growth. The lead is very flaky and breaks off easily.

Right—At this point the growth of the lead tree ends. Such a demonstration makes an effective parlor trick.

The tin tree at the completion of its growth takes on this form. This growth is much stiffer than the other metal trees, and has its own characteristic shape.

Flashes from the Radio Lab

Hum Level Testing Equipment for Receiving Tubes

THE question of hum in a.c. receivers is of more importance this year than ever before. This is due to the fact that great improvements have been made in speaker and audio design which give much higher reproduction at sixty cycles than sets previously put on the market, and, naturally, any sixty cycle hum picked up from the power line is then amplified where in former years the amplification of this particular frequency would not have been audible in the speaker.

When the question of excess hum arises, the repairman's first test should be the detector and first audio tube.

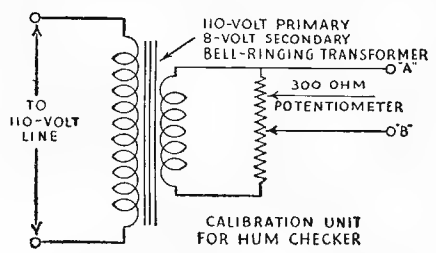


Fig. 1

The average serviceman will change tubes using the aural method of comparison, but, as the time required to heat the -27 type tube is between twenty to forty seconds, the degree of hum between one tube and another is a matter of pure guesswork.

The only reliable test which can be made is with a meter, the scale of which is calibrated in degrees of hum.

For those who wish to make "hum" measurements, a vacuum tube voltmeter, calibrated for the nature of the work, is used.

The instrument is calibrated with an eight volt bell-ringing transformer and will enable the serviceman to pick out tubes that are "hum free" and also from the annoying "fry" reproduced in the loud speaker.

The parts used and their connections are shown in

The indicating instrument should be of reliable make and is an O-1.5 m.a. milliammeter. The plate voltage should be 135 volts "B" battery (eliminator will not do).

The tube best suited for the instrument is the high-mu 240 type and is connected to a four-volt battery without a rheostat. The bypass condensers and resistor can be chosen at the discretion of the builder.

After the parts are mounted and connected it is ready to be calibrated in DEGREE OF HUM.

Connect a bell-ringing transformer across the power line and to the secondary terminals connect a 300-ohm potentiometer.

As shown in Fig. 1, the terminals "A" and "B" of the calibration unit are connected to the corresponding posts of the V. T. voltmeter. Using an a.c. meter (the one on your set checker will do) adjust the potentiometer so that you are passing just one-half volt of a. c. into the input of the V. T. voltmeter. Re-adjust the potentiometer for each half-volt variation up to about six volts a. c. and note the corresponding change on the V. T. milliammeter scale.

Did you notice that the larger the a. c. input the lower the reading on the milliammeter scale? This is how the serviceman can check the "hum level" of tubes in a receiver.

The V. T. voltmeter calibration curve should be charted on graph paper, after which the transformer and potentiometer equipment can be removed and the terminals "A" and "B" of the V. T. voltmeter is then connected to the output terminals of any receiver which is being tested for "hum."

With the set in operation and detuned from a station, the milliammeter will show you the hum level of the tubes in the set at the time. Changing tubes will change the meter deflection and the serviceman can then easily determine which particular tube increases or decreases the overall hum of the set.

The instrument can also be used to make comparison between different makes of tubes, receivers and power amplifiers.

The addition of such an instrument to the testing equipment will more than pay for its construction cost and is an asset to the service department, making it easier for them to give the customer more efficient service plus "hum free" reception.

D. A. Brown
Marion, Ohio.

The three interesting items that follow were contributed by Leo Born, of Topeka, Kansas

S. W. Receiver Coils

High-frequency receivers, being very critical, require coils designed to eliminate all possible leakage. Since bakelite has a dielectric constant of about 16, it is desirable to substitute some material in which the loss is lower. However, the more common dielectrics are undesirable because of lack of strength or expense. Wood soaked in paraffin has practically no loss whatsoever. In order to further reduce the losses, small pieces should be used.

Boil matchsticks in paraffin for about five minutes and when dry, glue them to the sides of the coil form equal distances apart, so that the wire which is to be wound on the form will not touch its sides. At the same time, such an arrangement increases the diameter of the form, facilitating the winding of low-frequency coils on forms of small diameter. If enameled wire is used,

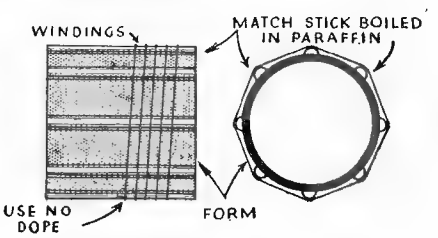


Fig. 2

space each turn slightly. In any case, wind the wire tight enough so that collodion, shellac or other commonly used adhesives will not be necessary to hold the windings in place.

Improving Audio Quality with "C" Bias

Many "hams" believe that a small "C" battery in the audio amplifier of high-frequency receivers is useless. However, such is not the case. Not only does it increase the volume of incoming signals, but also saves "B" batteries to a great extent and prevents distortion,

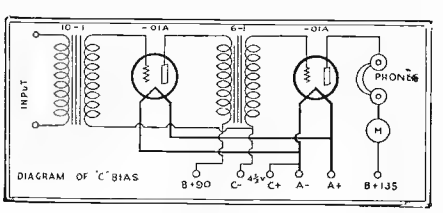


Fig. 3

Using a four-tube set with a screen-grid radio-frequency amplifier, a milliameter connected in the plate lead of the last stage registered 4 milliamperes with a 4½ volt bias on the two stages. Without the "C" bias, the meter registered 6 milliamperes showing that the use of a "C" bias saves the "B" batteries one-third. (See Fig. 3.)

When using the bias, the meter would deflect over a greater scale with a loud signal than it would when no bias was used; a proof that the "C" bias is worth while.

(*Continued on page* 553)

How to Build a SCOUT

By Lieutenant H. A. Reynolds

This Article Concludes Series on the SCOUT Wings, Center Section faces Were Covered in Third Took Up the Framework Details. The the Process of Covering

Above—

Lieut. H. A. Reynolds

Is an officer in the 368th Field Artillery who, since the war, has spent much time in glider construction and experiment at his home in Syracuse, N. Y. . . . In the construction of the Primary Training Glider, featured in S. and I. in the four months ending May, 1930, and of the present SCOUT Secondary Glider, his experience has been outstandingly important.

Below—

Herr Martin H. Schempp

Studied gliding under the famed Wolf Hirth at Stuttgart, and after graduating from that university continued his air training from both the operating and manufacturing sides. . . . Arriving in the United States, he joined the first soaring plane expedition, led by Dr. Wolfgang Klemperer, into the Alleghany Mountains, afterward going to Michigan for towed-glider experiments in the vicinity of Detroit. He is contemplating intensified work in the glider field.

THE framework of our SCOUT glider with all the metal fittings and wiring is done. We are now ready to give the glider its clothes. But before we put on the fabric, the wings and controls must be well varnished for protection against moisture. We either apply the varnish with a small brush, or for faster work we may be able to borrow a painter's spray gun. No varnish should be applied to the top or bottom rib straps or to any of the woodwork which will come in touch with the cloth afterwards. The casein glue which is used to fasten the fabric to the frame does not hold on varnished wood. If the spray gun has been used for varnishing we shall have to scrape all these parts clean. While the varnish is drying, we prepare the cloth covering.

The cloth may be cambric or unbleached cotton. A good grade of airplane fabric can be bought from the Heath Company, Chicago. Mr. Bowlus used No. 100 cambric for his record soaring plane; this quality is of light weight and takes the dope well.

The cloth is cut in panels, of whatever width you procure, which are long enough to reach around the wing from leading edge to trailing edge, with about two inches to spare. These panels are sewed together edge to edge until you have enough sewed panels to make a sheet long enough to reach from the butt end of the wing to its tip. This sewing must be done on the household sewing machine and each seam must be sewed at least twice to insure strength. This constitutes all the machine sewing that is necessary with the panel method of covering.

With the bottom surface of the wing framework up, *glue and tack* the cloth to the bottom of the main front spar all along its length. The cloth should be rolled up as shown in the drawing. Apply a liberal amount of thick casein glue to the bottom side of all the ribs on out to the trailing edge of the wing. The cloth is next rolled back towards the trailing edge and rubbed in good contact with the glued surfaces of the ribs. Small pushpins can be inserted here and there to hold the cloth in position. Do not glue or fasten the cloth to the trailing edge. At least three or four workers ought to do this job of covering, for fast work is necessary if the glue is not to be dry before the cloth is secured in place. Four hours should be given for the glue to set and then the whole wing frame is turned over so that you may cover the top surface. The cloth is stretched tightly from the trailing edge and fastened to the top edge of the front spar. Instead of applying the glue to the ribs, fasten the cloth first with tacks, and then with glue rubbed into the cloth where it makes contact with the framework. The glue will penetrate, and smearing the glue all over the wingcover will be prevented. Glue and small wire brads should be used in attaching the cloth to the top edge of the front spar. The cloth is next stretched over the varnished cardboard on the leading edge, and glued, overlapping the starting point, to the bottom of the front spar. It will be found easier to cover the leading edge if the wing is carefully placed in an upright position with the trailing edge resting on the floor. All the tacks must be pulled out after the glue is dry. To make this easier a small strip of cardboard should be put between tacks and cloth.

The ailerons, stabilizer and rudder are covered in the same manner. Start from one edge of the spar and carry the cloth around over the trailing edge until you arrive at the starting point where you overlap and fasten. The cloth covering may present a saggy appearance in places, but this should not irritate us, as the dope will shrink it tight and cause these hollows to disappear.

From his wide experience, Herr Martin H. Schempp offers this trailer outfit as a practical one for the average glider club. Trailers of this type find wide use among German glider clubs.

The position of the center of gravity of the glider is to be checked. Set the assembled glider on a small round log or a piece of a pipe. A person of average weight, about 140 pounds, takes the seat. The glider is now shifted fore and aft until it balances in flying position. This ought to be done inside or at least in a protected yard, since any wind causing lift on wings and controls would give us a wrong result. The con-

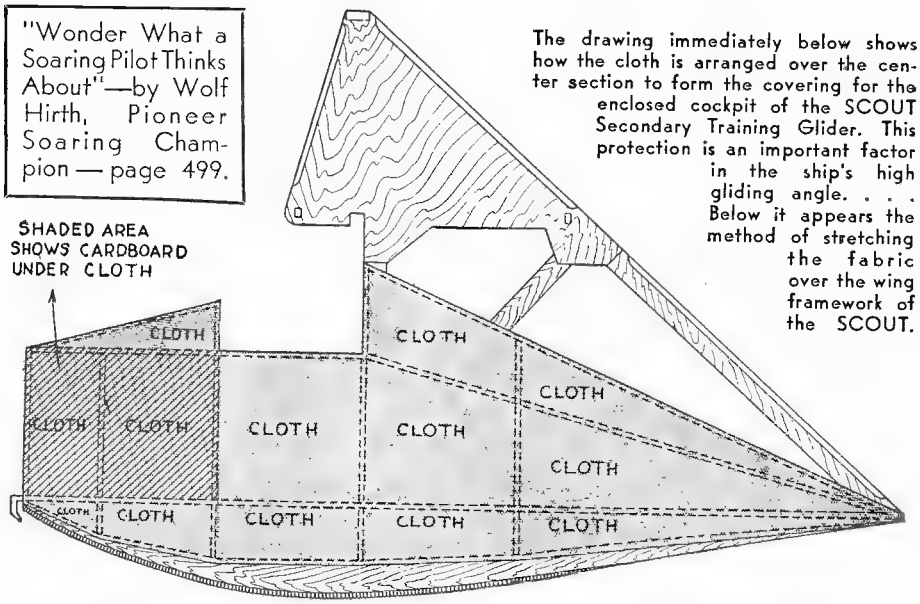
Secondary Glider

and Herr Martin H. Schempp

the Construction Secondary Glider. and Control Sur- the First Two. The Control System and Fourth Describes the Ship with Fabric

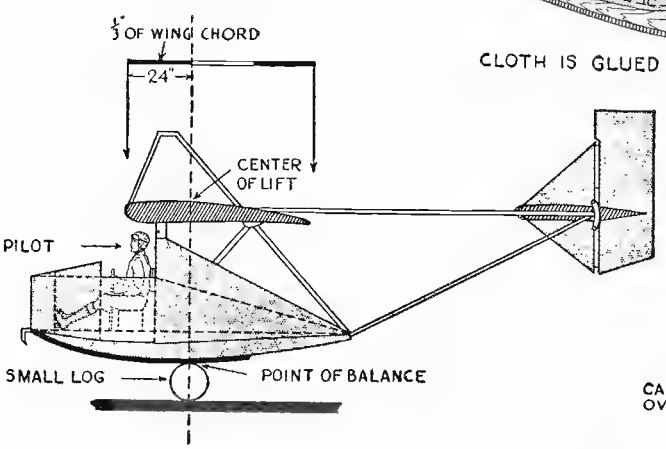
"Wonder What a Soaring Pilot Thinks About"—by Wolf Hirth, Pioneer Soaring Champion — page 499.

The drawing immediately below shows how the cloth is arranged over the center section to form the covering for the enclosed cockpit of the SCOUT Secondary Training Glider. This protection is an important factor in the ship's high gliding angle. . . . Below it appears the method of stretching the fabric over the wing framework of the SCOUT.



CLOTH IS GLUED OVER FUSELAGE AND GIVEN TWO COATS OF DOPE

In balancing the SCOUT, the roller is placed at a point marking the limit of 1/3 of the wing chord.

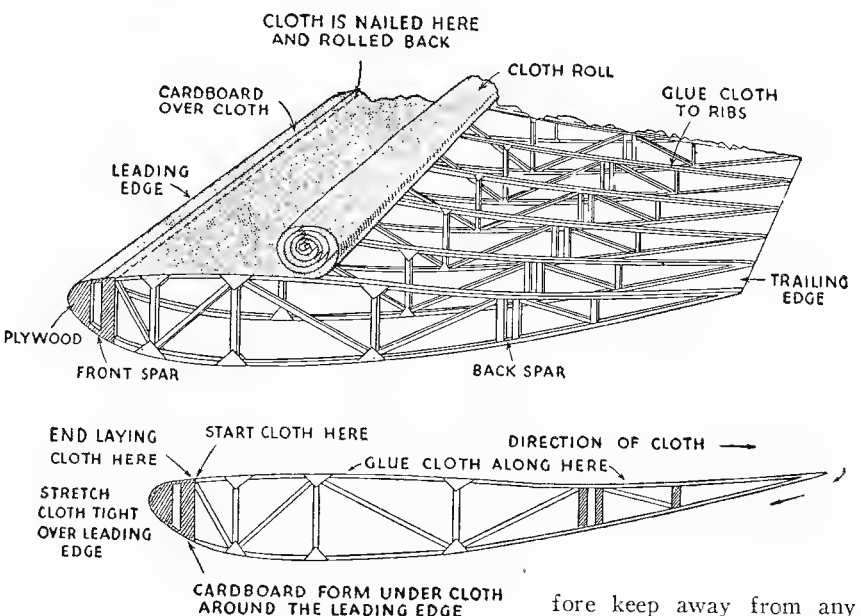


tact point of ash skid and roller should be exactly under a point of the wing one-third of the wing chord back from the leading edge. Here is the center of lift of our airfoil and the center of gravity always must be very close in its neighborhood to avoid any nose- or tail-heaviness in the glider. If these two points should not be in a vertical line we can correct it by shifting the seat a few inches forward or backward. A slight nose-heaviness does not matter much, but tail-heaviness should be absolutely avoided, for it may become dangerous. In an extreme case of tail-heaviness we fasten some kind of a weight to the nose of the glider. The fuselage is next covered by cutting the cloth in strips to fit the contour of the longerons forming this section.

The rounded nose of the fuselage back to the second bulkhead is covered with varnished cardboard to preserve the streamlined shape. Apply a liberal amount of glue to the wood strips and tack the cloth in place. Use glue to cement the overlap of each strip of cloth. The tacks are pulled out after the glue is dry. Patches of cloth are glued on to the covering at the points where the rigging wires will come out through the cloth of the fuselage and wings. These patches are pierced for the wires after they are dry.

About ten gallons of clear nitrate wing dope will be necessary to complete the cloth for flying purposes. It is most practical to apply the dope with a five-inch bristle-width paint brush. Pour a small quantity of the dope in a wide-topped basin and cover a small area of the cloth at one time. Dope is highly explosive. Therefore keep away from any fire. Work the dope into the cloth thoroughly so as to fill all the pores. Three coats should be applied with at least five hours' drying time between coats. Aluminum powder can be mixed with the last coat of dope if a more professional appearance is desired. Skin friction cuts down the flying performance. Therefore we want a wing surface as smooth as possible. With fine sandpaper the wing should be sanded carefully after the last coat of dope is dry. A still better plan is to sand between each two coats of dope.

Now let's put on a few safety devices to protect the pilot in hard landings. The (*Continued on page* 565)



New Ideas for the Home Machinist

By George A. Luers

This Page of Ideas for the Home Machinist Is a Regular Feature of SCIENCE AND INVENTION . . . Its Author Is a Consulting Engineer by Profession, and Is Supervisor of Ordnance Design at the Naval Gun Factory, Washington, D. C.

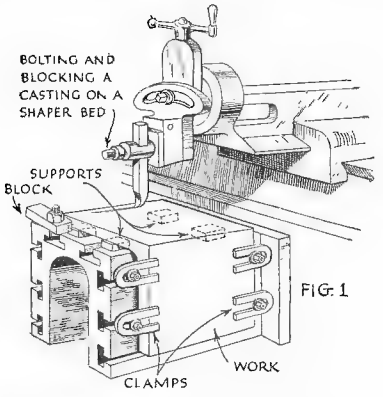


FIG. 1

Setting Up Work on Shaper or Planer Bed

IN shaper or planer work the first important consideration is to prevent the work from moving while cutting. The second is to prevent the work springing down or away under the thrust of the cutter. In Fig. 1 is shown the set-up for an angle bracket casting by bolting this to the side of the table and providing supports on the top. The blocking and clamping are such as not to distort the casting, but to hold it firmly. With the vise to hold work on the shaper, it is only necessary to grip the ends of the job firmly. If a number of similar parts of equal size and uniform thickness are to be machined, these are first rested on parallels in the vise to make them all even, and then gripped. If no vise is at hand, the parts can be clamped to the table, rested on parallels, using stop blocks to prevent endwise movement.

Grinding Planer and Shaper Tools

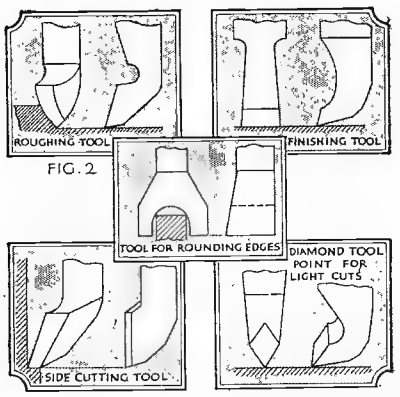


FIG. 2

THE correct cutting edges to be provided on tools for planer and shaper work are shown in the views on Fig. 2. Tools should be ground for each specific type of cut required of the tool. Observe the roughing tool in which the edge curves and is sloped on the front face. Then the flat-face finishing tool for light cutting and facing. This tool is especially good for cast iron. There is another type of tool for side cutting, that is for vertical feed cutting down into the work. Also, a diamond point tool for light fine cutting, where a thin cross section cannot readily be supported against bending away from the tool. For rounding edges of plates, angles or castings, the radius tool is best. This is ground with inside radius as required.

It is a good idea for the home machinist to familiarize himself with the various tools that are used for definite purposes so that he will not have to think twice before he sets up any piece of work. Do not expect to get first-class results from a tool poorly ground or made of soft steel.

Shaping of Rack Teeth

THE first procedure in rack cutting is that of gashing the teeth. For this purpose a tool for cutting is used, the shape being that shown in Fig. 3. Where the teeth are scribed on one surface of the rack it is only necessary to move the shaper head over the amount of the tooth pitch. A block made to the pitch dimension of the teeth is useful to establish the cross movement of the shaper ram. After gashing, the finishing cutter, made to the exact size of the tooth space, is used to finish the teeth. The same spacer block is used to make the cross movement of the shaper head exact while finishing. It will be understood that each time the block is used it is set from a stop adjacent to the shaper head. The required measurements for the cutter of the rack are shown in the illustrations of Fig. 3.

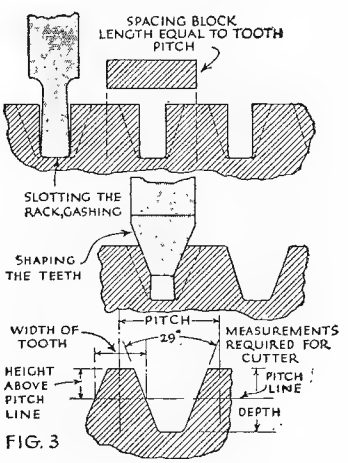
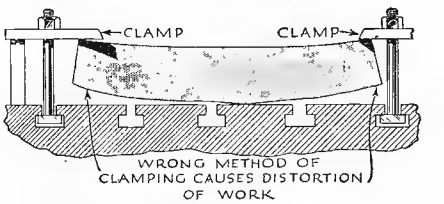


FIG. 3



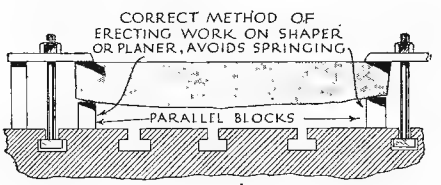
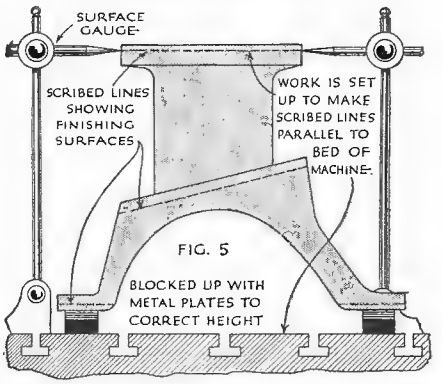


FIG. 4

Distortion of Work on Planer or Shaper

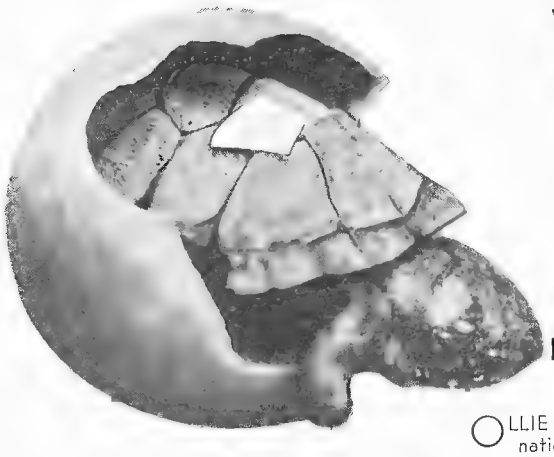
THE mechanic will frequently find a curved surface where the cut was taken. The main cause of this condition is incorrectly securing the work to the planer or shaper bed. The upper view, Fig. 4, shows how work may be deflected in clamping, coming out uneven. In the lower view, Fig. 4, the correct method of securing the work is shown. Note clamps are directly above supports placed between the machine bed and work.

Lining Up Work with Surface Gauge


SURFACE GAUGE
SCRIBED LINES SHOWING FINISHING SURFACES
WORK IS SET UP TO MAKE SCRIBED LINES PARALLEL TO BED OF MACHINE
BLOCKED UP WITH METAL PLATES TO CORRECT HEIGHT
FIG. 5

THE surface gauge is used to set up the job on the planer or shaper, following the method shown in Fig. 5. In using the surface gauge, the casting or part is placed on blocks and adjusted to height by additional variable thicknesses of metal plates or bits of sheet metal. The casting is raised at the low corners until the scribed line on the casting, to which it is desired to machine, is the same distance above the machine bed at all points. It may be necessary to use very thin sheets of brass in addition to metal plates, in order that the work may be set up even. Once set up correctly and clamped down the planing or shaper work can proceed. Machining on the surface will follow squarely and coincide with the scribed line.

Would You Believe It?



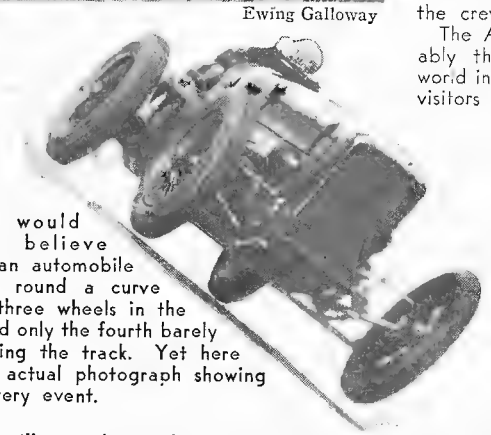
A Shell Within a Shell

MOST celonians come from soft-shel eggs, a fact not generally known. Here we have a remarkable photograph of a baby tortoise emerging from a hard-shelled egg. There is a difference between turtles and tortoises. The former are aquatic and some species never go on land except to breed. The tortoises are terrestrial. These reptiles lay eggs which are buried in shallow excavations on sandy beaches or on the hillsides.

It is also not generally known that there are soft-shelled turtles. These have a leathery covering and an extremely long neck.

What are colloquially referred to as "mud turtles" by the youngest generation are nearly always specimens of the tortoise family, which makes its home on land.

Ewing Galloway



You would never believe that an automobile could round a curve with three wheels in the air and only the fourth barely touching the track. Yet here is an actual photograph showing this very event.

His Job Is Counting Bullet Holes

OLLIE N. Shriver, a famous international rifle shot, is official scorer of the National Rifle Association at Washington, D. C. He examines thousands of targets sent in by marksmen from all parts of the country. Miss Dowd, one of his assistants is handing him a batch of bullet holes to examine. It must be tiresome to look at nothing all day, even when it has rings around it. But a job is a job.

A Twenty-two Pound Statue

THIS life-size statue of George Washington was modeled by Charles W. Cook from pulp made from old newspapers. It was then covered with a bronze weather finish. The statue weighs only twenty two pounds, and can easily be lifted, as Mr. Cook demonstrates.

Where Soft Stone Washed Away

A REMARKABLE perpendicular strata of rock several hundred feet high, and known as the Devil's Slide, is found at Croyden, Utah. The softer stone between the two outside perpendicular walls has been wearing away for centuries and now one finds a sort of a trenched toboggan slide. It looks like a mountain on the moon. Note the intense black shadow in the crevice.

The American West is probably the richest area in the world in marvels of this type, as visitors will testify.

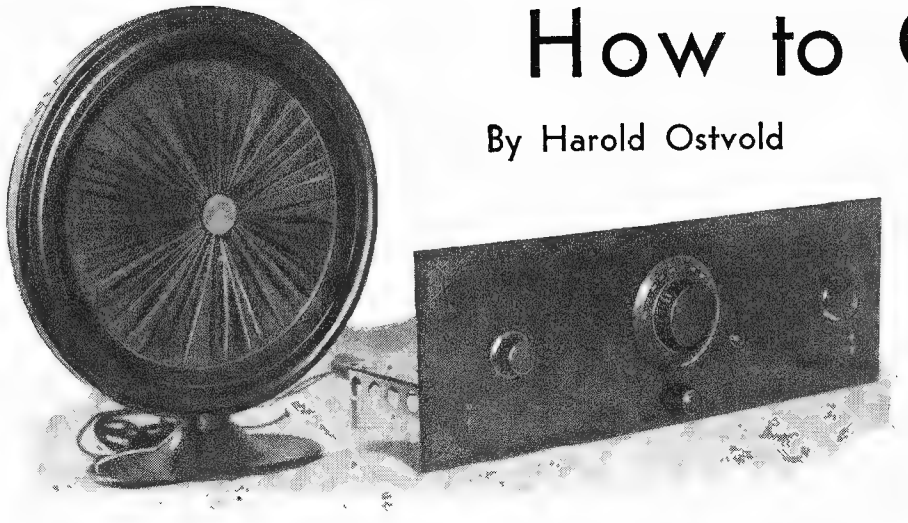
What Sea Pressure Does

A BUOY, with a cable attached, and launched from the cable ship Dominia was forced under by the Gulf Stream current and collapsed by the great water pressure at a depth of three miles below the surface. This is what the buoy looked like after it was recovered. In the September number of Science and Invention a diving bell was described in which Explorer William Beebe descended to a depth of ¼ mile below the surface.

Racing on One Wheel

ALTHOUGH he couldn't do it in America, Kaye Don continues to break automobile records in England. He is here shown in his powerful Sunbeam racing automobile tearing around the Brooklands track at a speed of 137 miles an hour, establishing a new record for the track. Careful observation will disclose that three of the wheels of the racer are shown completely off the board track, as Don takes a hairpin curve.

We will pay $5.00 for each photograph accepted and published on this page. Address, "Would You Believe It" Editor, c/o SCIENCE & INVENTION, 381 Fourth Avenue, New York, N. Y.

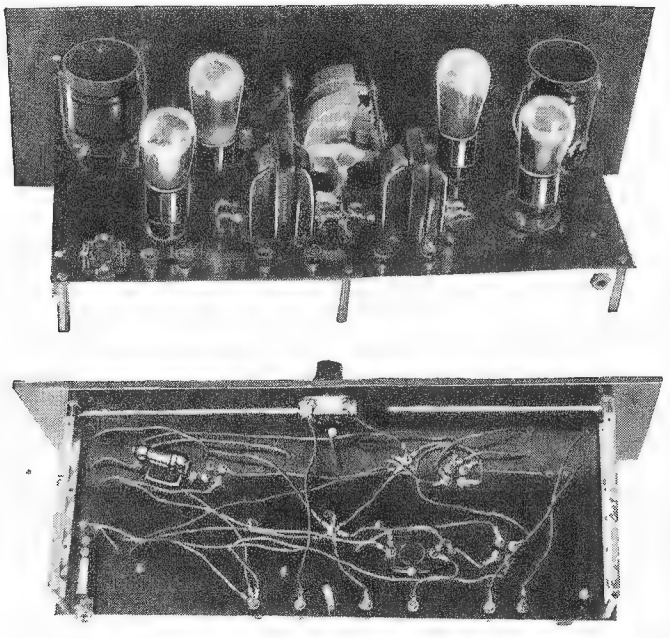


How to Construct

By Harold Ostvold

Here's a simply built, operated four-tube from equipment which experimenter's junk Low cost, easy of construction and tone quality with are only a few of its

IT is quite the thing in this day and age, to have a multi-tube set, "run by electricity," and superlative price. The younger readers of the radio publications of today have brought to my ear many an exclamation of disgust and dismay at the sets displayed therein. Why so many parts? Why so many tubes? Why so expensive? These and other questions often reach my ear. Most of the younger generation have not the money to spend on a multi-tube, all-electric receiver, and it is for this class that I set out to design a set, one appearing well and comparing generally in tone with the higher-priced factory receiver. Of course the only circuit could be the time-tested and time-proved four-tube radio-frequency-detector and two stage amplifier circuit, and with this as a basis, I set out to make a single-control set, neat in appearance, simple in construction, of good tone quality, and a low price. The circuit finally evolved lived up to my expectations entirely. Naturally, I used only the cheaper grade of "dime-store" parts as that is the kind most popular with the "poverty-stricken" youthful experimenter of today. I chose the sub-panel method of construction as this makes a much neater-appearing job.



Above, a rear view of the four-tube receiver, showing the layout of the equipment which is used in the assembly of this simply constructed receiver. The two tuning-coil units are at the extreme ends of the back of the main panel, while the double-gang tuning condenser is centrally located. Binding posts along the rear edge of the sub-panel provide connection of the batteries, antenna, loud speaker, etc., to the receiver. Directly above is shown an under-the-panel view of the sub-panel, showing the location of the output jack, fixed condensers, variable resistor and carborundum detector. Note that point-to-point wiring is employed throughout.

The tone quality of the completed set is really very good when one takes into consideration the inexpensive audio transformers used; and one friend of mine said it was one of the neatest-appearing and best working home-made jobs he had ever seen. Its volume is very good and most satisfactory for home use, in fact it requires tuning down on local stations when using —01A tubes throughout. Stations within a radius of 500 miles may be brought in with sufficient volume for comfortable hearing. Selectivity is very good, and in the district where I live, where nearly everybody is troubled with interference, this set tunes them all out on almost one point on the dial.

All parts are standard, no "trick" ones being employed. No neutralizing is employed for the simple reason that it is not necessary. Tuning is simple and volume is practically constant over the entire broadcast wavelength. All in all it is a set of which any family may be proud. Now as to the actual construction.

A 7"x21" and a 7"x18" sub-panel are used. The sub-panel may be a 7"x18" panel which generally comes at a lower price. The drilling of the front panel should be done from the drawing furnished (see Fig. 2). Sockets of the sub-panel type have been used by the author chiefly because of their low cost and neat appearance; others may be substituted if desired. Two three-circuit tuners of the small size are used. These should be purchased because they must be matched within certain limits. The tandem condenser should be one which has small midget condensers attached to compensate for any differences of circuit variations. I will refrain from a circuit analysis as this will merely tend to complicate matters. Sufficient to say that the signals from the antenna are built up by the first stage radio-frequency and passed on to the detector where they are rectified and the signal changed from radio-frequency to audio-frequency. Two stages of audio-frequency amplification build up the signal to loud speaker volume.

Several variations have been introduced into this circuit. For instance, the tickler coil in the radio-frequency transformer is placed in series with the regular primary and ground connection, where it acts as a volume control, sensitivity control, and to a certain extent the regeneration control, in fact, to a far enough extent that when the rest of the circuit is balanced it may be used solely for this purpose. In the detector circuit the grid leak has been replaced by a crystal detector which seems to suppress squeals, and sharpens selectivity, as will be seen when a grid leak is substituted. With the grid leak it becomes necessary to introduce some form of neutralization.

The audio circuit is standard and two transformers of three and one half to one ratio type may be used, although if different ratios are desired a five to one should be used in the first stage and a three and one half to one in the last stage. No output transformer is used because it is not

the Home-Builder's Four

single-dial battery-receiver assembled is usually found in the box or supply cabinet. operation, simplicity wiring, and excellent adequate selectivity outstanding features.

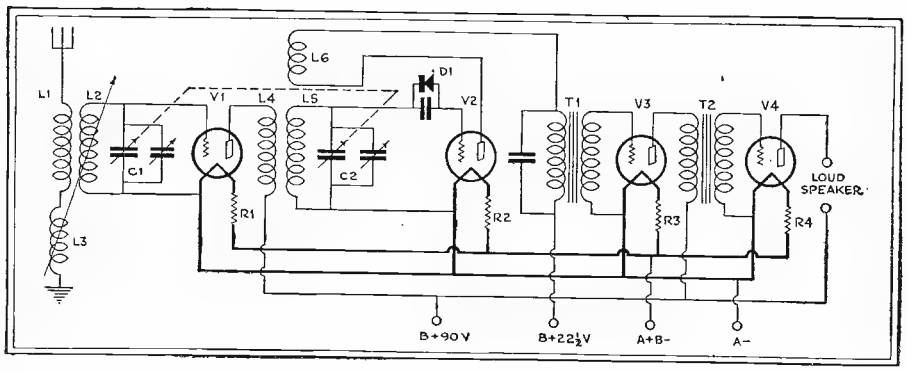
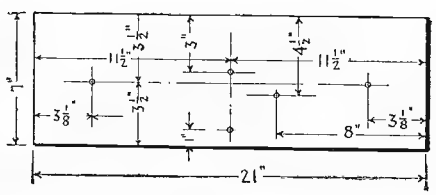
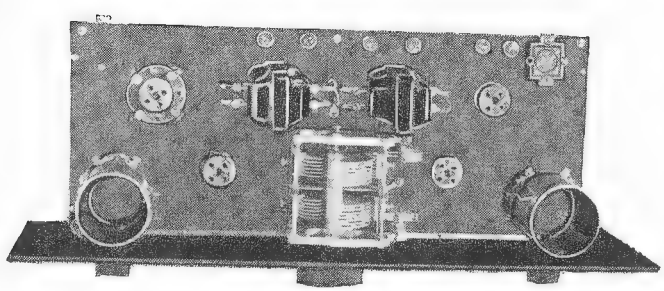


Fig. 1. Above is shown a complete circuit diagram of the four-tube receiver. In the antenna, stage L3 is connected in series with the primary L1 so as to obtain variable antenna tuning. Note that a carborundum detector D1 is employed instead of a grid leak. Fig. 2 to the left shows the layout of the various holes which must be drilled in the main panel for supporting the various instruments mounted thereon.

necessary to protect the speaker, as high voltages are not present in the set, no power tubes being employed. If it becomes desirable to use a power tube of the -12A variety, 135 volts "B" battery and 9 volts "C" battery should be used. In the event that still greater volume is desired such as delivered by a -71A, -45A, etc., it is advisable to use a power pack to provide the high voltages. Also use an output filter to protect the speaker. Another thing; in the event that it becomes impossible to procure the condenser described, a common two-gang condenser can be substituted, each section of which should be shunted by a small three-plate midget condenser. The one tuning the detector circuit should be placed on the panel. The other may be mounted on the sub-panel, and after one adjustment need never be touched.





To the left is shown a top view of the completed receiver. Note that the symmetrical layout is maintained and that very few of the connecting wires appear above the sub-panel. The sub-panel is fastened to the rear of the main panel by means of a pair of brackets. Small trimming condensers located on the side of the main tuning condenser keep the circuit in alignment at all times.

Putting the Receiver into Operation

The adjusting of the receiver, although not complicated, varies with the location, battery voltages, antenna, etc. The author has tried the set on various locations with different antenna systems and voltages, and not any place has it been necessary to change the original adjustment except a minor turn on the midget condenser on the front panel. These two midget condensers and the tickler coils are the only parts requiring adjustment when the set is first put in operation. This can be determined by various positions until the set can be operated over the entire wavelength, using only the main tuning control, without squealing or other background noises.

LIST OF PARTS

One tandem condenser, C1, C2.
Two three-circuit tuners, small size, L1, L2, L3, L4, L5, L6.
Two audio transformers, T1, T2.
Four tube sockets, V1, V2, V3, V4.
One fixed condenser, .001 mfd., C4.
One fixed condenser, .00025 mfd., C3.
One fixed crystal, carborundum type, D1.
Four filament resistors, ¼ amp. each, R1, R2, R3, R4.
One panel, 7x21.
One sub-panel, 7x18.
Binding posts, wire, solder, hardware, etc.

If the set is completed according to the article a most satisfactory combination of tone quality, volume, and sensitivity will be had.

Attention!!! Radio Experimenters, Servicemen and Short-Wave Fans

SCIENCE AND INVENTION will pay full space rates for articles submitted and accepted for publication describing novel radio receiver designs, short cuts in construction, hints for the laboratory and serviceman, and new ideas in radio.

If you have built a receiver which you believe is better than the average, if it employs some new circuit kink or a unique design let us know about it. Probably the other readers of this department will be glad to know about your work and duplicate your job.

All manuscripts submitted should be legibly written, (typed would be better) and should be accompanied by drawings, sketches and commercial photographs.

Here's a chance to make some pocket money.

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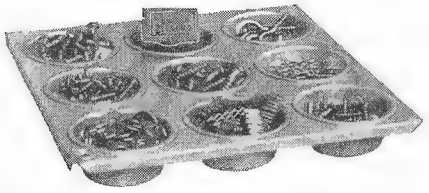
Try These in Your Own Workshop

By Gale Vance and R. B. Wailes—Two of the Handiest Handy Men Among Our Writers in the Workshop Field



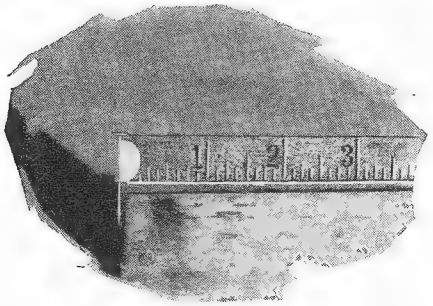
A muffin pan makes an excellent receptacle for small parts.

A Small-Parts Holder

A VERY convenient receptacle for bolts, screws, washers, brads and other small parts can be found in the ordinary "tin" muffin pan. One muffin pan or a group of them can be placed on the work bench or they may be stacked one on top of the other and conveniently labeled. Perhaps one of the best systems of all is to improvise a rack having ordinary upright sides to which narrow strips of wood are nailed, so that the muffin pans can be allowed to slide back and forth on these strips like so many drawers. The size of the cabinet will depend entirely on the size of the muffin tray that is to be employed, and enough clearance should be allowed between adjacent trays so that if one of the recesses is full of material, the material will not accidentally be brushed off by the tray above.

A One-Hand Rule

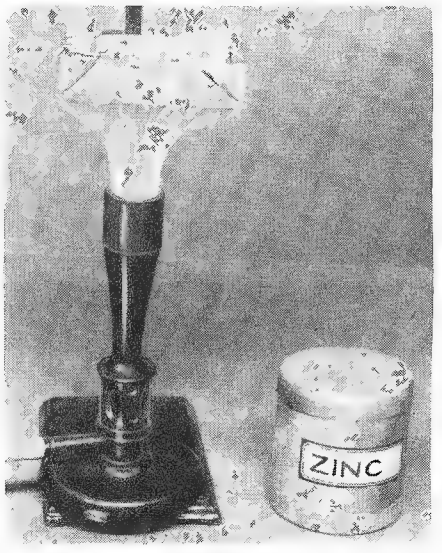
A LONG rule is easily converted into a one-hand affair by making a little metal sheath and soldering this to the metal tip of the rule at the zero end. The sheath should allow for the insertion of a nail. The rule can then be set against the side of the wood and measurements can be made with only one hand holding the rule and with but little difficulty in properly holding it in position. Tapping the nail with a hammer will hold the rule on the board in any spot desired. With the nail as a pivot and with a pencil held against the rule, circles can be scribed. The method also presents a way of easily drawing straight lines and the rule will not slip under the fingers as it customarily does with the old style.



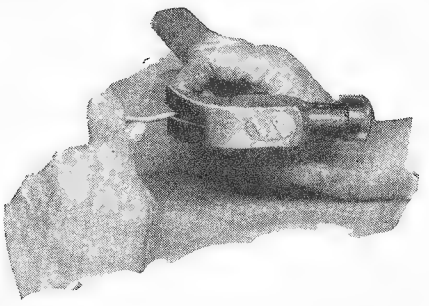
Soldering a little metal sheath at the zero end of a metal-tip rule and thrusting a nail through the sheath will hold the ruler in place.

Galvanizing on Short Notice

IT may be necessary on occasion to galvanize small objects or articles for rust prevention, but the average experimenter does not usually know how to go about it. Here is an extremely simple method that works to perfection. The small metal article is well cleaned and then immersed in soldering fluid. For those who do not know what soldering fluid is, we would say that this consists usually of a zinc and ammonium chloride solution. Zinc chloride alone will work very efficiently here. The article is then taken out of the solution and immersed under the surface of a tray of molten zinc metal. The tray can be made out of a simple piece of tin folded up and around at the corners, as the photograph indicates. A Bunson burner will produce enough heat to melt the zinc. Lump sal ammoniac thrown over the surface of the hot molten zinc from time to time will enable the work to receive a better coating of zinc.



A simple process for galvanizing small articles at home is photographically shown here and the instructions are embodied in the text.



Here is a way in which you can straighten a bent nail between the claws of a hammer and the fingers.

Straightening Bent Nails

FREQUENTLY when driving nails, some of them are but slightly bent, and the home workshop enthusiast would like to straighten them and use them, but owing to marring of other surfaces he will not make an attempt to pound them with a hammer. This is a bad practice to get into, anyway. Many a builder has spoiled a fine finish by setting the nail on a smooth surface and striking it to straighten it. If the system here depicted becomes a habit, it will be found just as serviceable and less accident-provoking. The bent nail is gripped between the claws of the hammer and straightened with the fingers.

A Cellar Shelf

IF in the need of a number of small shelves, preferably positioned in out-of-the-way places, the home owner will find that a few boards nailed to the ceiling joists and at right angles to them, make ideal shelves for miscellaneous little used articles. Hundreds of things can be stored on such shelves without needlessly cluttering up other valuable space.

Driving Long Staples

WHEN long staples are driven into wood, especially if the wood be oak, hickory, ash or maple, the staple has a tendency to flatten out, causing an unsightly effect and inefficient result since the ends of the staple fail to hold.

To overcome this, simply set an adjustable wrench so that it will fit the sides of the staple loosely. Tap the staple in position and then hold the wrench in place as demonstrated in the photograph until the staple has been driven home.

Driving a long staple without flattening it.

Prize Puzzles to Polish Your Wits

By Sam Loyd

THE Puzzle King presents the tenth of a series of problems, the solving of which will show if your mathematical ability is bolstered up by logical reasoning. Prize winners of the July puzzles and solutions will be found on page 569.

TWENTY-FIVE DOLLARS IN PRIZES

A FIRST PRIZE of $10 will be awarded to the person sending correct answers to the three puzzles accompanied by the best expressed analyses of the Main Street Problems.

A SECOND PRIZE of $5 will be awarded for the next best analyses and correct answers to the three puzzles.

TEN PRIZES of $1 each will be awarded to the ten persons who send the next best analyses of the Main Street Problems together with correct answers to the three puzzles.

Answers must be received not later than noon, October 15, addressed to "Puzzle Editor," SCIENCE AND INVENTION, 381 Fourth Avenue, New York City.

All contestants must abide by the decisions of Sam Loyd, who will examine all papers and award the prizes.

Papers of identical merit, tying for any one of the prizes, will each receive the full amount of the prize tied for.

Heard on Main Street

Solution in January Issue Science and Invention.

AN old fellow in our town is too mean to give you the time of day. When young Jones greeted him the other morning and asked for the time, old Perkins glanced cautiously at his big silver timepiece and replied as follows:

"Just add one-quarter of the time from midnight until now to half the time from now until midnight and you will have the correct time."

"Just so," assented the flabbergasted Jones, and to cover his embarrassment he expressed admiration for the old man's watch.

"It's for sale," volunteered Perkins. "Pass over —— dollars and this fine ticker is yours."

Jones offered Perkins seven dollars less than he asked, and then they dickered for a while. Finally Perkins knocked off one-third of his price and Jones increased his offer twelve and a half per cent., but they were still one dollar apart, and parted company without doing business.

However, the colloquy was not in vain, for it provides our puzzlers with a pair of posers.

If Perkins told the truth in answering young Jones' request for the time that morning, then what time was it?

Our second problem is to determine from the given facts just how much Perkins demanded for his timepiece in the first place.

An Amusing Scotch Solitaire Problem

THE Scotch are great checker players, and to the "canny" race we owe most of the recognized sound openings in draughts, such as the "Laird and Lady," the "Glasgow," the "Fife," the "Ayrshire Lassie," and others.

No true Scotchman goes upon a journey without his little pocket checkerboard, and on the railways numerous games will be seen going on between passengers who have become acquainted through the introduction of their favorite pastime.

On a trip from Edinburgh to Glasgow, I was challenged to a game in the customary way by an old Scotchman, who proceeded to not only humble my pride in what I considered my own fair knowledge of the game but show me a thing or two about checkers that proved to be first-class puzzles.

"Perhaps you have never heard of Scotch Solitaire," he said among other things. "Well, the idea is to place twenty-six checkers haphazard upon the board and then proceed to see if your arrangement will permit of continuous jumps to clear the field."

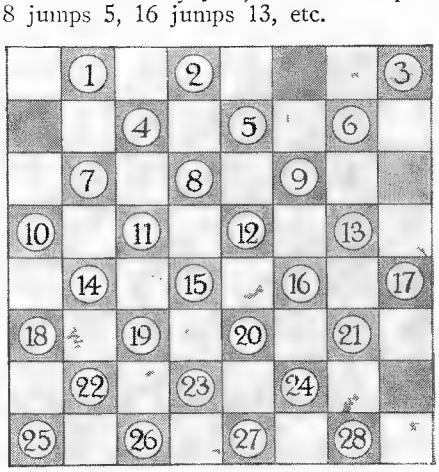
I found Scotch Solitaire to be a fascinating pastime, and finally had the satisfaction of increasing my Scotch friend's group of men from 26 to 28. This number can be posed, as shown in our sketch, for removal by continuous jumps.

To work out the problem, place 28 bits of cardboard, buttons, coins or checkers upon the numbered disks. Then jump the markers about, diagonally as in checkers, and assuming that every checker is a "king," privileged to jump backward or forward. There are to be no *moves*, only *jumps*, and at each jump the one jumped over is removed from the board.

The puzzle is to perform a series of jumps that will sweep the board of 27 markers.

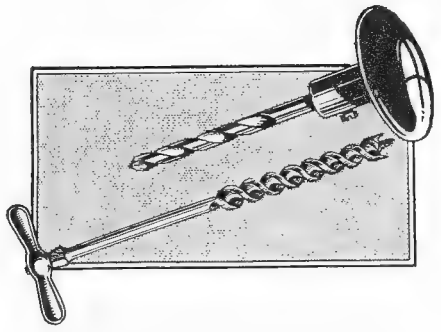
The men are numbered to provide means of recording your jumps. You will note that the four vacant squares permit of a choice of five opening jumps, viz.: 8 over 5; 11 over 7; 16 over 13; or, 16 over 21.

When a man lands upon a vacant numbered circle, it should be noted by that number on its next jump. Set down a sequence of the numbered men in the order they jump. For example: 8 jumps 5, 16 jumps 13, etc.



First Prize $5.00

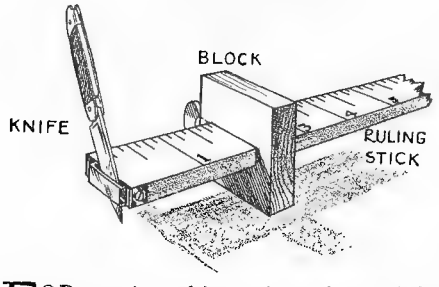
WRINKLES



Substitute Brace for Drilling

WHEN one is employing straight shank drills and bits in a small place it is often found awkward to use a brace. I have overcome the difficulty by using a faucet handle and door knob as shown in drawing. The drills fit quite nicely in both of these articles, and where a great deal of force is unnecessary (for drilling soft wood or bakelite, etc.) they save the day.—*Leslie F. Carpenter.*

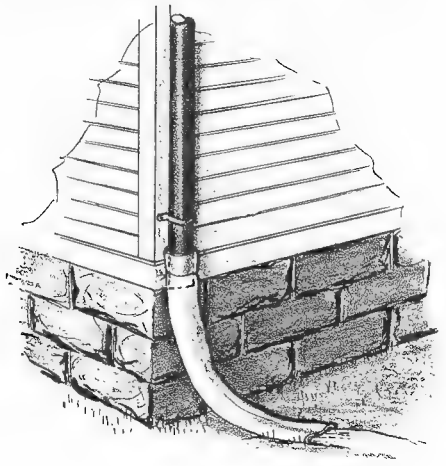
Cutting Gauge



FOR cutting thin strips of wood in making model airplanes and boats fasten a knife to the end of a ruling stick with a small piece of copper and adjust the block for the width of the cut.—*Kenneth Hayes.*

Tire Sections for Leader Ends

THE discharge of water from the downspout off the roof soon makes a very bad hole in the ground if allowed to fall directly upon the soil. A section of discarded tire, cut as shown and fitted to the bottom of the spout will lead the water away from the foundation of the house and spread it out upon the ground where it can really be used to advantage.—*R. Wailes.*



Cutting the Neck of a Bottle

THE simplest way to cut the neck of a bottle is to wrap a string saturated with turpentine about it. Ignite the string and when it has almost burned out, if the glass has not cracked, dip the neck of the bottle as far as the string, into a pail of water. When the glass comes in contact with the cold water, the neck will crack off and fall into the pail. Another way consists in scratching the bottle at the place where it is to be broken by file or glass cutter, then gently heat the scratch over a small flame and dip into water just up to the scratch. A clean break will usually result.—*H. Bade.*

To Prevent Warping

TO prevent wood, especially smaller blocks used as base boards for various instruments, from warping, all that need be done is to dry the wood thoroughly and then coat it with melted paraffin. Placing the wood in the melted paraffin is best, although similar results are obtained by coating with a brush and then, if necessary, working the paraffin into the wood with a hot flat iron. The wood so treated is impervious to moisture and will not warp.—*H. Bade.*

CONTEST AWARDS
Winners in SCIENCE AND INVENTION'S Every-Month Contests Are Announced on Page 555 of this issue

To Anchor Lagging to Metal Pulley

THE necessity of lagging a metal pulley which had no holes for anchoring and the fact that there was no drill handy suggested the following method. Several layers of friction tape were first wound tightly around the wheel, then the leather was cut to fit the circumference. Small nails, just a trifle longer than the combined thickness of tape and leather, were driven straight through. They clinched upon hitting the metal and the job was done.

Cobbler's nails answer the purpose quite well, although I usually employ shingle nails, cutting them off to the required length.—*Joseph Straughan.*

Plant Stand or Table

CAST iron tops of old hot air registers can be bought for almost nothing and any blacksmith can add curved legs that will make a most artistic out-of-doors table or plant stand.—*Mrs. Guy W. Oliver.*

Can Handle as Ice-Cube Tongs

A HANDY, small pair of tongs, of the type used to remove the little cubes of ice from the electric refrigerator, may be made by bending a wire can handle or a piece of wire. The wire handle is first straightened and bent into triangle form, as shown in figure 2. The closed apex of this triangle is twisted, as shown in figure 3, leaving a small loop by which it may be hung in the pantry.—*Louis Andrews.*

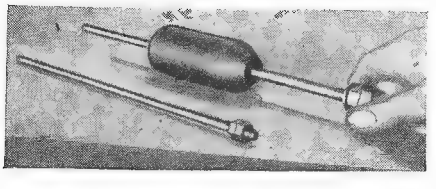
To Open Jars

NO trouble will be experienced in opening screw-top bottles and jars if the containers are turned bottom side up and struck on the floor. Care should be taken to strike the top squarely on the floor.—*F. L. Dunham.*

A Useful Tool for Shops

THE cage to the main bearing of many automobiles is very tightly seated and difficult to remove because of its inaccessible position. The job is made easy by using a small steel rod, several inches long and threaded at both ends. A section of metal weighing a pound or more, preferably round, is bored through the center to fit on the rod. A tap or two, with washer, is screwed on one end of the rod, and the other end is screwed into any threaded hole in the caging. Tapping against the nut at the bottom end with the heavy piece of metal will pull the cage from its seat.

The device may be used in removing any inaccessible part, provided that there is a threaded hole, although different sized rods must be used to fit the work in hand.—*Jos. C. Coyle.*



and RECIPES

Dibble for Planting Onion Sets

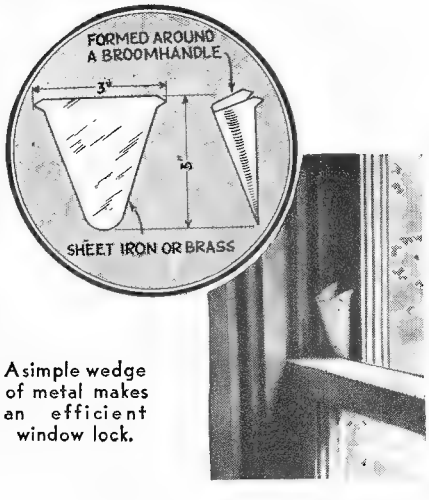
TAKE an old umbrella handle, such as the one illustrated. Sharpen by whittling to a point. It is very easy to plant vegetables, onion sets or bulbs by merely making a hole in the ground with the dibble wherever you wish to put a set. A string stretched between two stakes and fastened to them, will enable you to plant in a straight row.—*Raymond Wailes.*

For Women Car Drivers

FREQUENTLY it is impossible for the woman car driver to wash her hands after changing a tire on the road. If she will keep a jar of cold cream in one of the car pockets along with a large cloth, she will find it very easy to dry-clean her hands.—*Leafa Gardner.*

A Window Burglar Lock

A WINDOW burglar lock can be made by cutting a piece of heavy sheet metal as shown in the sketch. The sheet metal is then formed around a broom handle into the shape of a wedge. The windows are raised and the burglar lock is inserted between the sashes. The sharp points on the lock dig into the wood and prevent success of any attempt to raise the window.—*Robert J. Williams.*



A simple wedge of metal makes an efficient window lock.

To Clean Bath Tubs, Tile, and Sinks

BATH tubs and sinks or the bath room tile, when they are dirty, are usually quite hard to clean with soap and water, and one may lighten his labor and bring out natural lustre of the porcelain by using a cloth which has been dampened with kerosene or gasoline. It is a good plan to keep a small screw top can filled with kerosene in the bath room closet at all times for convenience.—*Mrs. Dorothea Beeman.*

Driving in the Rain

OFTEN in a driving rain the ignition system on a car will get wet and cause the car to stall. I carry an atomizer filled with carbon-tetra-chloride with which to spray the distributor head, coil, wires and spark plug porcelains. It is a quick and sure way of getting started.—*Oscar E. Lindstrom.*

Shaded Bulbs

ELECTRIC light bulbs that are entirely colored may be readily converted to the tipped type by sandpapering the paint coating down to the curve in the globe. This shades the glowing filament from the eyes, and at the same time gives a higher percentage of light than if the bulb were used with its paint coat intact.—*Frank R. Moore.*

$5.00 is paid each month for the best Wrinkle or Recipe accepted and published in these columns. All others used are paid for at regular rates. Address: Editor, Wrinkles and Recipes.

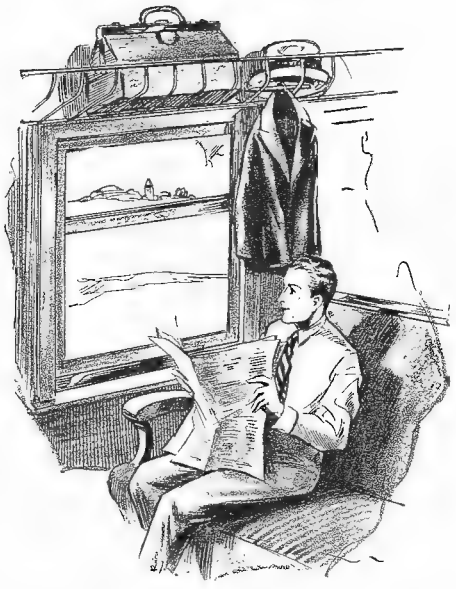
Rubber Cork for Star Drill

IN using a star drill on cement work or brick work, get a large rubber cork, such as used in chemical laboratories, or a liberal strip of two-inch wide rubber from an automobile tire. Place the rubber cork or band around the star drill and it will be very much easier to use since the rubber deadens the jar of the stroke of the hammer.—*Horace Le Master.*

Freshen Typewriter Ribbons

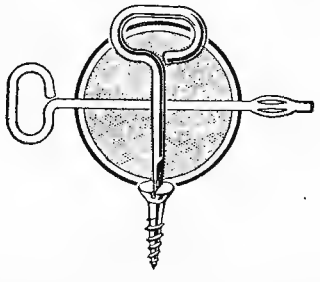
TYPEWRITER ribbons that have been in use for a while are frequently cast aside and replaced with new ones, though the ones cast aside could be made to give as much service as some of the new ones. Just put several drops of some light oil over the edge of the roll, and lay the ribbon aside for a few hours. The oil will freshen it up considerably.—*Horace Le Master.*

A Coat Hanger



WHEN traveling on a train, hang your coat on a lead pencil, placed as shown above.—*Ernest Peterssen.*

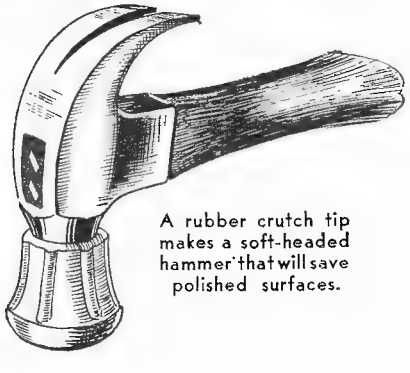
Powerful Midget Screwdriver



BY clipping one inch off the end of key, such as comes with malted milk and other cans, and filing the point to a proper edge, one can make a very good little screw driver. It will not bend or break even on large screws, and its size will admit of its use in places where larger screw drivers would not answer. As the key has a ring end, it can be placed on a key-ring, always ready for use.—*Louis Andrews.*

Soft Headed Hammer

AN ordinary hammer with a rubber-crutch tip slipped over the head makes as good a rubber mallet or soft-headed hammer as one can buy. Its uses are many; it saves the surface when pounding on polished wood, furniture, etc.—*Eugene Keyarts.*



A rubber crutch tip makes a soft-headed hammer that will save polished surfaces.

The SAFETY

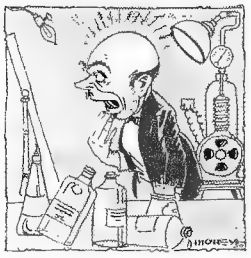
Readers' Opinions and Comments

Wants to Grow Hair

WILL you please tell me if any of the hair-growing dope is of any use for growing hair? I have tried several kinds with no luck.

R. E. Sells,
Bergen, Alta., Canada.

(On some heads there is just as much chance of growing hair as there would be on a billiard ball. If you will refer to the May, 1929, issue of this magazine, you will find in this department quite a lengthy treatise on the subject of Alopecia. Practically all of the hair-growing systems benefit to some extent even though they will not grow hair in each and every individual case. They do have a tendency to increase the circulation of blood in the vessels of the scalp because of either massage, heat, or other forms of stimulation. We would suggest that you go to a good dermatologist, ask him whether hair will eventually return, and if he definitely says "no," ointments, salves and other mechanical devices will be of no avail. The only thing that will then stop falling hair is glue.—Editor.)



He Objects

FOR a number of years I have followed with great interest and satisfaction the unusually decent and morally sound method in which you have edited your Science and Invention—free from all objectionable, indecent, naked, suggestive pictures and articles that are so often a foul blot in so many otherwise praiseworthy magazines and papers in this country.

Only on one particular occasion either last October or November, Science and Invention Magazine printed a somewhat rash and slightly indecent exposure of the body, which, however, I believe must have escaped your careful and prudent judgment.

Someone recently said very truthfully, that certain business men in this country would dish up "fried manure" for the public, if they would be paid for it, and this actually happens often enough, in the moral filth and disgusting sewage that some editors periodically dish out, to the grave scandal and mental ruin of innocent children and clean-minded Americans.

I believe that the public "tar-and-feather" method would be doing these rascals a favor—ostracism would be the real thing for them. If you can assure me that your magazine will always keep its noble, decent high level and standard, and not be influenced by the crying wants of some morons, I will do all I can to spread it among our students and to "broadcast" it, as a magazine that can be safely read by any age, class or type of person with profit, pleasure and interest.

Please inform me of your future plans for Science and Invention.

Yours for a prosperous and sane future for Science and Invention.

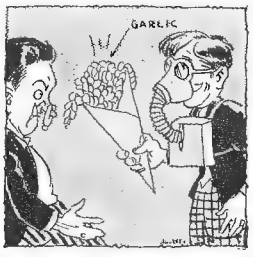
Bede Mitchel, O. S. B.,
Subiaco College,
Subiaco, Ark.

Science and Invention *Magazine has always attempted to portray the scientific side of life. We never were particularly interested in developing what is popularly termed "sex appeal". The transgression of which you accuse us was not done with such intention, but was merely an attempt to portray another peculiar and mysterious scientific manifestation.*

We are extremely doubtful if any future issue of Science and Invention *Magazine will show the body purposely partly unclothed, nor do we presume that any article in the publication will tend toward indecency.*—Editor.)

A Bouquet of Garlic

MR. AMOS UTTERBACK seems to have no love for loving cups—on the contrary, he likes garlic blossoms. I am sorry to say I am unable to get garlic blossoms in my city, otherwise I should be tempted to send him a bouquet as an award for his "Model" letter.



I am a proud and satisfied winner of the trophy awarded for the August Model Contest 1928. I am sure all the other winners would rather win this fine loving cup than a bouquet of garlic blossoms, or a quartz crystal, etc., which would be rather useless to a fellow who has not the other necessary apparatus to go along with them.

Modestly writing—men with brains enough to build a model that will win a Science and Invention Model Trophy surely must have enough to build a lathe of their own.

But—"when its garlic blossom time in Modelland, my model will not be there"—but send yours in Mr. Utterback, it will surely win the prize.

A. R. Cann.
Victoria, B. C., Canada.

A Wave-Motor

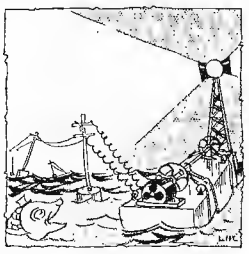
I NOTICED in your April issue of your Science and Invention you commented on an idea of a wave-motor by one W. B. Jaruis, Marshfield, Ore.

I have invented an ocean swell motor. After over twenty years of study and experiments, I fail to find any power available in the waves of the ocean front.

I, therefore, turned my attention and study to the ocean swell, away from the destructive breakers and from the line of navigation, where there is always one foot or more of rise and fall in the swell of the ocean.

The description of arrangements, construction and application is as follows:

An air-tight float, 40 × 80 feet and 12 feet deep, is firmly anchored at both sides, both fore and aft, and sprocket chains are secured to each of the four anchor chains,



passing up and over and engaging four release sprocket clutches and extending downward with heavy weights attached to free end of each sprocket chain which passes from port to starboard and from starboard to port. The above sprocket clutches are oscillated on counter shafts, upon which are secured sprocket pulleys engaging sprocket chains transmitting power to the main shaft.

The main purpose of the invention is for the purpose of generating electricity, and the power generated will depend on the weights attached to the free ends of the sprocket chains.

Many mechanics and aviators have declared its unlimited possibilities for lightships along the coast and at submerged islands *en route* to the Hawaiian Islands and elsewhere.

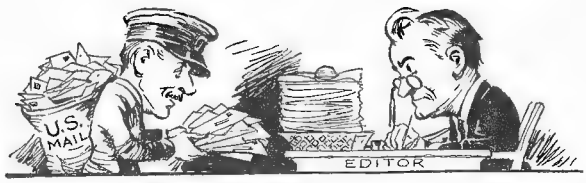
The float is to be housed, towered and lighted at night with signals for fog. The applications for patents for the above are now pending.

F. W. Morse,
San Fernando, Calif.

(It is, of course, true that ocean swells and waves do provide an immense source of power. It is likewise true that up to the present time any installation utilizing ocean waves and swells as a source of power has been extremely costly. Not only is the initial cost high, but the cost of maintenance is greater than the cost of maintaining turbo-generating stations, where it may even first be necessary to build a dam at a high initial expense, but where there is also a possibility of utilizing the impounded waters for irrigation purposes if it is fresh water. There are many factors that interfere with tide, wave and swell motors. Flotsam, wreckage, ice, winds, difficulty of maintaining a mooring and variability of the power must all be considered. Eventually this form of energy will be utilized, but there are countless other sources of power that are available today, wherein the cost of operation and the cost of the original installation is better in its economic relation to the results obtained, to even a greater extent than in tide, wave and ocean-swell devices. There are certain geological formations where tide motors might give remarkable results. The rise and fall of the tide in the Bay of Fundy is great enough to produce worth-while results at nominal cost. Until such time as our natural resources of fuel, such as coal and oil, become sadly depleted, and the cost of such fuel becomes too high for practical purposes, and until the time comes when it will be impossible to obtain artificial fuel at a reasonable price from other forms of natural resource, swell and wave motors will not be looked upon seriously. Many inventors have discovered this through sad experience. If there is anyone who has proven contrariwise by an actual working model, we would like to hear about it. The whistling buoy and the bell buoy are about the best examples of existing present-day wave-motors.
—Editor.)

VALVE

Conducted by
JOSEPH H. KRAUS



Will Be Welcomed by the Editors

A Mind-Reader

A LADY mind-reader came through here a few years ago. She was blindfolded and seated on the stage. Then the people in the audience would think of their questions and she would answer the strongest one that she was supposed to receive by mental telepathy. I didn't see this demonstration, but my aunt did and she is supposed to have had a question answered with startling correctness.

I am wondering if all that was possible without trickery.

DAN LEWIS,
Newkirk, Okla.

(There are two ways of describing any trick; one is from the standpoint of the spectator, and the other from the standpoint of the individual knowing the modus operandi. The chances are that if your aunt repeated all of the details which she remembered, she would still be omitting the vital and important facts. If you see a magician extracting a rabbit from a hat, you would probably swear that you actually saw the man produce a rabbit apparently out of thin air. In the "Sawing a Woman in Half" trick, a woman is apparently cut in two by a large saw. That is what the audience believes it sees. Actually, the rabbit is not fabricated out of air and no woman is cut in half. The same is true of this mind-reading trick. Are you sure that no questions were whispered to a confederate, that no slips of paper were written upon and placed in such a position that the individual blindfolded could get hold of them? Are you sure that messages were not dropped into a basket and were then collected by a person and the message transmitted via phone to the artist on the stage?

Remember, there is no such thing as genuine mind-reading. This publication has a standing award of $1,000.00 which it will pay to anyone who demonstrates that such an effect exists. We refer you to the article in a comparatively recent issue of this publication in which Baron Von Ardenne, who conducted a series of experiments over a period of more than two years, concurred in his opinion with our original finding. Baron Ardenne employed all sorts of amplification devices to amplify any frequency and used a human subject as a receiver.—EDITOR.)

Experimentally Minded

I AM a regular reader of SCIENCE AND INVENTION Magazine, and I would like to see more articles about chemistry. Experiments and hints for the amateur chemist is what I would like to see. More of Dr. Bade's articles. Scientific puzzles and questions are what I like. Do you remember the "Experiments With Acetic Acid," and "Flower Odors from Flasks?" They are the kind. Another thing I like and would like to see more of are the articles of Mr. E. J. Beck on Psychology. You must admit there is nothing more interesting than the everyday life which we see and fail to understand. Mr. Beck writes his articles in such a simple and easy-to-understand way that one gets the inside dope on that big word Psychology.

Hoping you will consider this note and its contents, I remain,

C. COLLINS,
Toronto, Canada.

He Saved Money

THANK you for the Patent Advice information. It will save me some gray hairs and green dollars. The more I think about it the more I am inclined to agree with you. Probably by the middle of next week we will be in complete accord. It was a punk idea. "Requiescat in pace." At that, it was no worse than the battery charger in the late SCIENCE AND INVENTION and he "Pat" it in the U. S. A. and Canada. (God help him ! ! !) Had he come to you he would have had a lot more of the long green to make whoopee with. Such is life. He did some good at that. I felt greatly encouraged when I found that there are a lot of people that have no more sense than yours truly. I am truly thankful for the advice and you may be happy in the thought that you "have not lived in vain."

A. A. PATTON,
South San Francisco, Cal.

(A great many worthwhile ideas come to the attention of the Patent Advice Department of this publication and the inventors are told how to improve the system, if that is possible, and also advised as to what steps to take. Such letters, as a general rule, do not find their way into the Patent Advice columns because we try to protect the inventor as much as possible. We expect that by pointing out the disadvantages in any construction, an inventor may devise a system which will overcome them. When he does so on a worthwhile idea, he should be able to make a paying proposition of it.—EDITOR.)

Magnetic Cures

FOR several years I have been a reader of your magazine, and have always found your statements and other data to be very helpful to me.

Quite some time ago, I believe I read an article regarding "Electrical Belts" and other so-called magnet cures.

If it is possible to give me any data whatsoever on this subject, or send me the magazine in which an article regarding this subject appeared, I will be very grateful to you.

W. HAROLD BARBER,
Chicago, Ill.

(There are so many different types of magnetic cures and electrical belts that have been exposed in this publication that you would have to cite specific articles before we could recommend collateral reading. If you will mention the article that seems so mysterious to you, we will be glad to comment upon it.—EDITOR.)

Wants More Scientific Contests

I THINK the plan outlined by J. G. Q. is very good. I also suggest that you would have more amateur chemistry in your magazine. I would be especially eager to see an amateur chemistry contest. I think you should have certain restrictions about age of persons entering. You should have one for young amateur experimenters; while for men experienced in chemistry, you would have a different contest.

How can anyone convince persons that believe in the moon affecting the crops, and those believing in the healing powers of electro-magnetic belts, that they're wrong?

HUGO A. BEISWENGER, JR.
Jackson, Mich.

(Well, no one can say that we do not try to tear aside the veil that cloaks superstitious belief in the advertised virtues of worthless articles intended for medical treatment or far-fetched applied science. We, too, would like to know how some people can be convinced.—EDITOR.)

Suggests We Investigate

IF you haven't done so, secure a copy of *Psychology*, turn to page 23 (December, 1929) to the title "I Have Talked with Ghosts!—A Report and a Challenge." Then get "Joe" on the job as soon as is humanly possible. You may be sure that here is something which may prove to be "interesting."

This "Dr." has held lengthy intercourses with all kinds of spirits. The interesting point is that he seems perfectly willing to prove it, if necessary. Let's hope that he is more in need of $21,000.00 cash than was Johnny Slater! This one has even kissed them!

I suppose that this has been called to your attention by the millions already, but I see no fault in making sure. I have perfect confidence in Mr. Dunninger and the Psychic Committee. Hoping that you will let me know if this case has any promise, I am

WILFRED RAGLIN,
Ypsilanti, Mich.

(Thanks very much for your kind communication and for your confidence in this organization. Unfortunately, every effort we have made to get someone to prove that spiritualism exists has been met with a prompt ouster order by the very spiritualists who asked for an investigation. We are now waiting for the spiritualists to call upon us. We do not tell them to "get out." The $21,000 is still at stake.—EDITOR.)

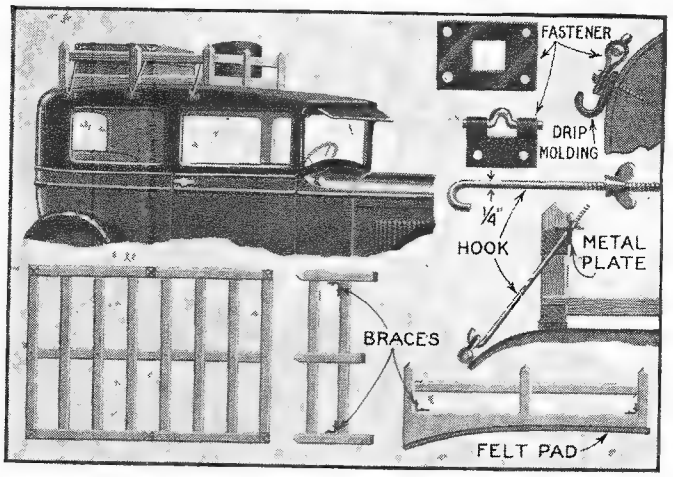
(Continued on page 573)

New Ideas for the Owner and Driver

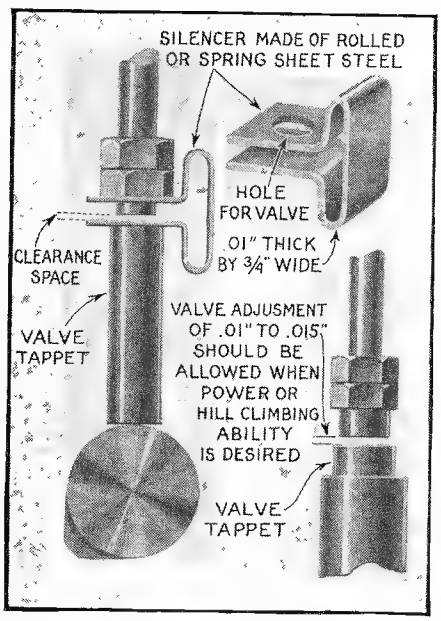
By Arthur George

The Author of These Monthly Hints Is an Authority on Motor Cars; Has Had a Wide Experience in the Auto Field, and Constantly Watches for and Tests the Latest Developments for Your Benefit

Top Rack for Luggage



THIS baggage carrier has a self-contained rectangular framework with a slatted bottom. It is mounted on two longitudinal strips fitted with felt pads. Six light sheet iron clips, using the same screws that hold the drip molding around the edge of the top, secure it to the car. Six one-quarter-inch rods are bent into hooks, which secure the frame to the body at six points by means of wing nuts. It is painted to harmonize with the body in color. The holder is placed high above the car, to protect from dust. A rubberized cover can be stretched over it and attached to the framed holder.

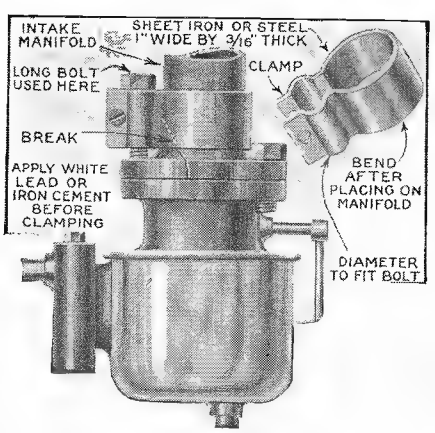

SILENCER MADE OF ROLLED OR SPRING SHEET STEEL
HOLE FOR VALVE
.01" THICK BY ¾" WIDE
CLEARANCE SPACE
VALVE TAPPET
VALVE ADJUSMENT OF .01" TO .015" SHOULD BE ALLOWED WHEN POWER OR HILL CLIMBING ABILITY IS DESIRED
VALVE TAPPET

To Silence Valves

IF silent valves are desired, small spring steel clips, made as shown in the attached sketch, can be put up between the valve and the tappet. This spring holds the tappet against the camshaft. The tappet is a loose piece in the engine assembly and so is responsible for the click which occurs when the engine is running. Any rolled elastic steel of spring steel about one-hundredth of an inch thick can be used.

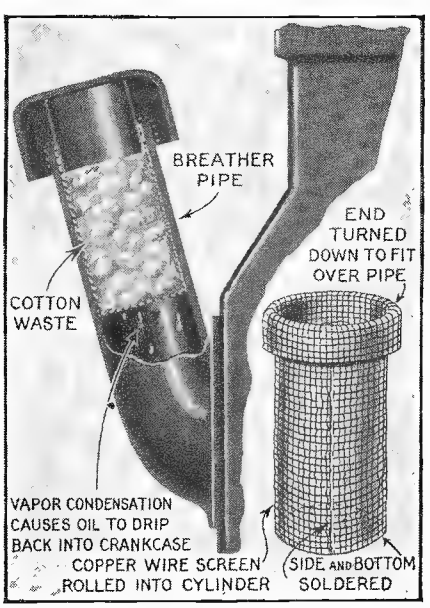
For a Broken Flange

FREQUENT breakages occur at the flanges of a radiator connection on the engine or intake flange of the carburetor. A piece of steel plate about an inch wide and 3/16 of an inch thick is bent to encircle the body of the connecting part and fit around the bolt hole. A small screw bolt is fitted through the ends; a longer one is substituted for the standard piece and is put through the repair sleeve and tightened down solidly. Leakage will be prevented if white lead or iron cement is placed in the joint before tightening.

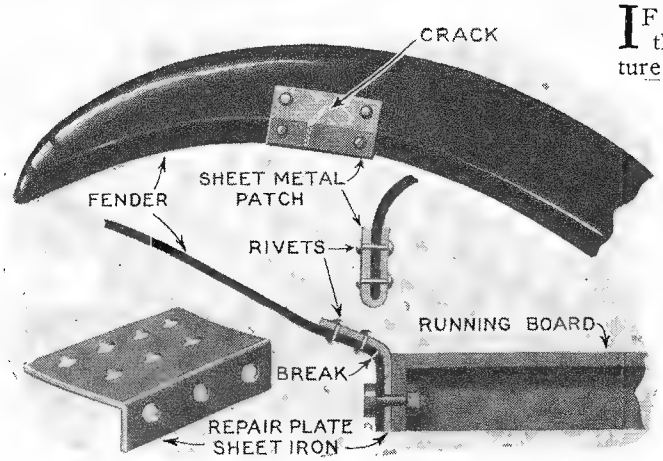

INTAKE MANIFOLD
SHEET IRON OR STEEL 1" WIDE BY 3/16" THICK
LONG BOLT USED HERE
CLAMP
BREAK
APPLY WHITE LEAD OR IRON CEMENT BEFORE CLAMPING
BEND AFTER PLACING ON MANIFOLD
DIAMETER TO FIT BOLT

Escaping Crankcase Vapors

TO keep oil-laden vapors in the breather pipe, take a cylindrical copper screen wire cage the size of the breather pipe to the crankcase. Roll its upper end to prevent its falling into the crankcase. The regular filler spout cap fits into the cage. Loose cotton waste, placed inside the cage, will collect the oily vapor. After the waste is blackened, it can be changed for fresh waste.


BREATHER PIPE
END TURNED DOWN TO FIT OVER PIPE
COTTON WASTE
VAPOR CONDENSATION CAUSES OIL TO DRIP BACK INTO CRANKCASE
COPPER WIRE SCREEN ROLLED INTO CYLINDER
SIDE AND BOTTOM SOLDERED

Patching Fender Cracks



IF your fender cracks at the edge or at its juncture to the running board, you can repair it. For the former, double over a piece of sheet metal, obtained from a heavy metal container. Slip on the edge of fender, clamp, drill four small holes through both fender and plate; then rivet in place. For the second repair, galvanized iron cut, bolted to the running board, clamped, drilled and riveted as shown, will do the trick. A little putty and paint will make the repairs inconspicuous.

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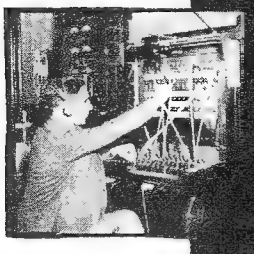

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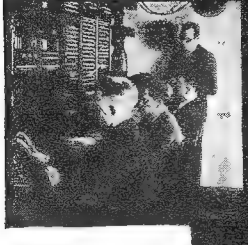

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MAGIC

By Thurninger*

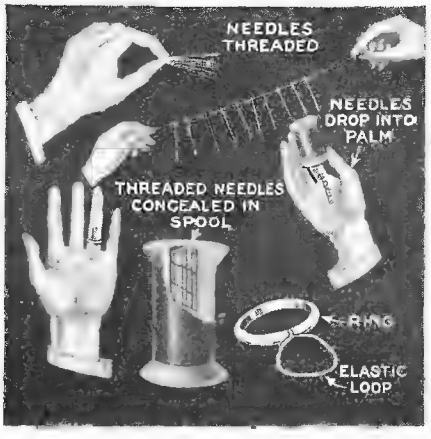
Boiled Alive

THE audience sees a large metal tank apparently filled with boiling hot water. Pails of water are passed out through the audience with the invitation for anyone to plunge his hands into the water at his own risk. The tank is mounted on a furnace through the doors of which one can see the flames. After a group of spectators have examined the tank and found that it was not prepared in any way, the magician's assistant is ostensibly hypnotized and in this state he climbs down into the tank and remains submerged beneath the boiling water for ten or fifteen minutes.

The secret lies in the fact that while some of the pails contain boiling hot water, other pails that also appear to be boiling actually have cakes of solid carbon dioxide in them. Clouds of steam rise from these pails. Naturally, when the water mixes, it is merely warm in the tank. The cakes of carbon dioxide that have been dumped in with the cold water make it seem to boil. Note tube for breathing.

New Needle Mystery

WITH this method, the magician demonstrates digital dexterity by threading needles while his hands are in back of him. The secret lies in the fact that a spool contains the needles already threaded. In the act of removing a piece of thread the magician lets the threaded needles slide into the palm of his hand. The unthreaded needles are secreted within an elastic loop attached to the finger ring.



An After-Dinner Trick

THIS impromptu trick needs no prearrangement. Pepper is sprinkled on the surface of a tumbler three quarters full of water. The magician draws a line across the surface with his finger tip and the pepper divides and remains so divided. The spectators cannot duplicate the stunt. The secret lies in the fact that the finger tip is first waxed. Wax obtained from the ear is satisfactory.

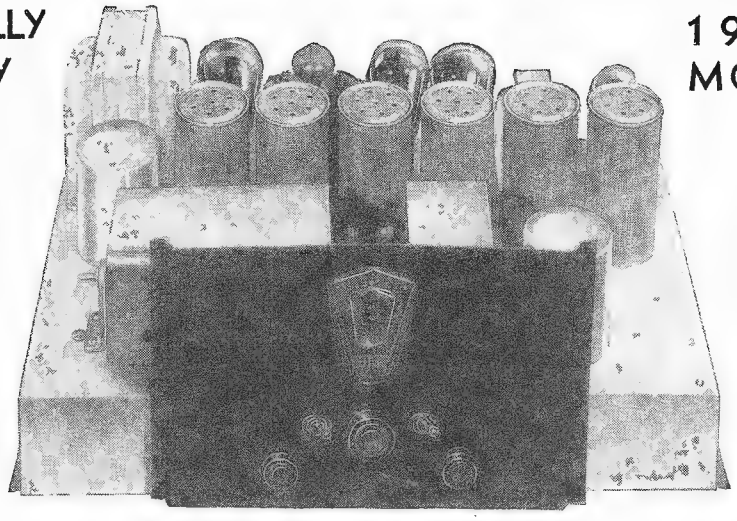
Airplane Ball

IN this effect the magician demonstrates that a brass tube is just large enough to house a billiard ball, by first putting the ball in the tube and then immediately removing the same. The ball is then vanished and again found in the brass tube. The usual billard ball and shell are used. When demonstrating that the ball fits the tube, it is left behind. The shell only is removed and allowed to pass up the sleeve.

*No. 85 of a series of articles on magic appearing monthly.

WHOLLY NEW

1931 MODEL



10 TUBES « « « « EMPLOYS HOPKINS BAND-REJECTOR SYSTEM

10 KILOCYCLE STATION SEPARATION « « « « WORLD-WIDE RECEPTION!

WHEN RADIO'S HISTORY IS FINALLY WRITTEN THIS AMAZING SUPER WILL BE SET DOWN AS

THE FIRST « « « REALLY GREAT RECEIVER

In the development of all arts and devices, there stand out epochal, basic achievements toward perfection. Motor car men know exactly the feat that marked the turning point to today's unfailing reliability of the automobile. The aviation expert knows what 'plane established the pattern of design and construction to insure safe travel through the air.

And, we know enough of radio now to make this bold claim that this wonder 1931 H. F. L. Mastertone 10 marks entry to an entirely new era in this new art.

The Super's the Thing!

Long known to be the ideal circuit for receiver use, it remained for H. F. L. to adapt the super-heterodyne to practical home reception. True to its name, the super has been the superior set in power, in selectivity, in pure tonal quality. Yet to combine these qualities with the demanded simplicity of control and ease of operation was a task that baffled radio's best engineers for years.

Now we have **all** these features in a history-making receiver and at a price that bespeaks the genius and cleverness of today's engineering skill and manufacturing ingenuity.

Awe-Inspiring in Action!

This receiver is actually, definitely revolutionary. It sets up entirely new standards of design, building and performance. Operation of silky smoothness that thrills you to new heights of radio enjoyment. Sharpness of selectivity that is truly breath-taking in its surprising precision. A sweet, full tone quality that is inspiring in its sheer naturalness! Power and reach that awes even the hardened, experienced DX explorer!

Why It is Different

H. F. L. exclusively uses the newly perfected Hopkins Band Rejector System, a circuit of which you will hear much from now on in radio. By this method, the width of the band may be adjusted to **absolute precision, without impairment of the audio.** Tune the entire scale in steps of 10 kilocycles, just as surely as you set the clock! Distant stations reproduced **with the same clarity and definiteness as locals!**

Try It at Home

Surging power that lays the world of broadcast at your finger tips! Tone that lifts you to the realm of illusion with the artists before you—reproduction that elevates you to hitherto unscaled heights of musical enjoyment.

Give H. F. L. the chance to prove all these unusual claims. Test the giant power of the Mastertone in your own home. Experience its uncanny separation of stations. Thrill at its amazing reach into the far corners of the world. Do this all at our risk.

Book Tells All

Details of this history-making receiver and our new policy of distribution, placing this wonder set within the reach of all, are set out in a new Brochure. Send for and get this book without cost or obligation. No salesman will call on you—you will not be importuned to buy. Write now. You owe it to yourself to know all about the H. F. L. Mastertone 10 before purchase of any new set.

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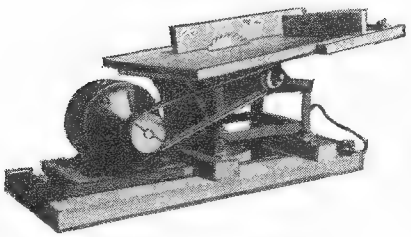
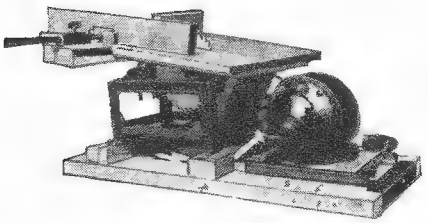
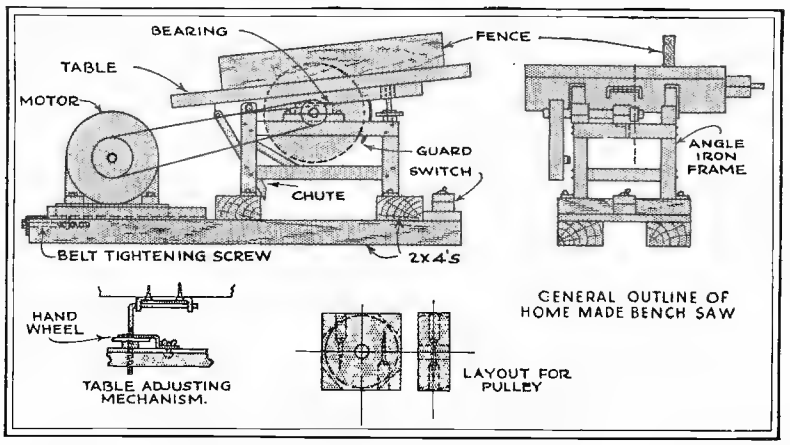


Bench Saw from Odds and Ends



By Elmer Verburg

Here Is a Bench Saw That Will Interest the Home Mechanic by Reason of the Fact That It Was Built Entirely of Odds and Ends to be Found Around the Average Shop.

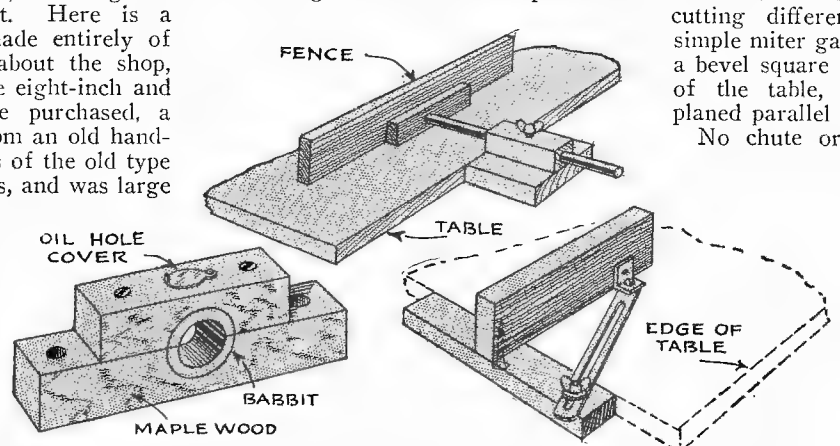


The photographs at the top of this page depict two views of the home-made bench saw with the miter gauge and fence in position. At the left is a complete diagram showing details of construction. Note particularly the simple table-adjustment mechanism.

PRACTICALLY every home mechanic is interested in a bench saw, but very few home mechanics have ever attempted to build one, thinking the task extremely difficult. Here is a bench saw that was made entirely of odds and ends found about the shop, while the motor and one eight-inch and one six-inch saw were purchased, a third saw was made from an old handsaw. The handsaw was of the old type with a uniform thickness, and was large enough to permit cutting a six-inch circular piece out of it. To make a saw that would take small, fine cuts, teeth were filed in the circular piece for cross cutting. The eight-inch saw would cut to a depth of two inches, but the quarter-horsepower motor proved too weak to drive it at this depth, so a one-third horsepower motor is to be generally recommended.

An old board much like a drawing board or bread board was found which served as a table. The frame was made of ¾-inch angle-iron riveted together. An arbor and set collar were easily made on a small lathe. An old knurled handwheel about two inches in diameter, found in the scrap, with a threaded piece of 5/6-inch rod, served to make the table-adjusting mechanism. Two pine two-by-fours were used for a base.

Pieces of angle-iron and a square board made an adjustable base for the motor to take up slack in the belt. The belt was made from an old discarded two-ply belt, the two pieces being ripped apart and cut to one-inch width. The two pulleys were made of wood turned down to shape on the shafts. The bearings for the arbor were made of hard seasoned maple wood lined with babbit and bolted to the angle-iron frame. Paper shims were inserted under the caps of the bearings so adjustment could be made to take up wear.



Above—Details of fence. Left—Method of making bearings. Right—Details of miter gauge.

The fence on top used for ripping was made of a plain piece of wood fastened at right angles to a rod which passes through a block fastened on the edge of the table. A thumb screw holds it for cutting different width material. A simple miter gauge was made much like a bevel square and used along the edge of the table, the edge having been planed parallel with the saw.

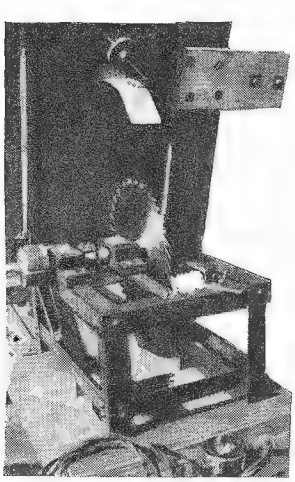
No chute or box arrangement was made to catch the sawdust other than a sheet to keep as much dust as possible away from the motor. A small guard was placed between the table adjusting handwheel and the saw to prevent the hand from being injured.

Plain oil holes were made in the bearings and small plates pivoted off-center were necessary to keep the sawdust from entering. There is a little catch over the handwheel of the table adjusting mechanism. By turning this the table can be tilted way up, making it easy to change saws or oil the bearings.

A piece of armored cable was led to the switch and motor passing between the two-by-fours from the top of switch in the front to the motor at the rear. The motor itself was a second-hand rewound job. In this construction, a one-quarter H.P. motor was used, which with the eight-inch saw was all right for light work, but labored when heavy work was pushed through.

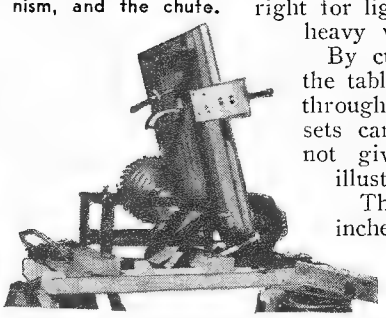
By cutting a larger opening in the table top and inserting a plate through which the saw runs, dado sets can be used. This detail is not given in the accompanying illustrations.

The table measures 16¾ inches by 22 inches. The over-all dimensions are 34 inches long, 22 inches wide, and 18 inches high.



The table of the saw raised to show details.

From these views one can see the mountings for the bearings, the table adjusting mechanism, and the chute.



Basement Improvement

(*Continued from page* 518)

the garage under the sunparlor.

We built carefully to avoid dampness in the basement, especially in the dining-room and kitchen. Under the cement floor we tamped cinders several inches deep and inside the foundation walls of cement we stood two-by-fours upright and lathed and plastered inside. The boiler room floor is 12 inches lower than the principal floor and the garage floor 3 inches lower, an emergency drain being placed in each.

All of our basement windows are 4½ feet from the floor and are twelve-light, 9 inches by 7 inches in size. The dining-room is 14 feet by 18 feet, with four such windows and the kitchen is 15 feet by 18 feet with five windows, thus making these rooms light, airy, and pleasant.

Off one corner of the kitchen and entering it through the laundry is a toilet room 5 feet 3 inches by 8 feet 6 inches. Taking this off the kitchen here forms an alcove which we use for a breakfast nook.

Our floors in living rooms are painted. In the dining-room we use an Axminster rug laid on deadening felt for a pad. We are investigating laying rubber tile on both these floors.

The house and garage are hot water heated throughout by a Williams Oil-O-Matic, which has given perfect service since installed in November, 1927. The oil supply comes from a 1500-gallon tank buried in the yard.

The ever-even temperature day and night with no attention and cleanliness because of no coal or ashes in the basement make these rooms particularly pleasant living quarters.

A much-desired feature of these rooms is that in winter they are warm with no draughts on floor and in summer quite the reverse—cool, and a much-sought place on hot days.

These rooms have some built-in features—the dining-room has a built-in buffet, a colonial stairway and closet for sewing goods.

The kitchen has a large built-in cupboard, telephone box, ironing board, electric refrigerator, sink with drain, electric hot water heater, and electric stove.

The laundry is equipped with stationary tubs with hot and cold soft water (piped either from furnace boiler or electric heater) and cold city water, clothes lines, laundry stove with faucet above from which to fill the boiler, a receptacle which holds the soiled clothing dropped in chute from upstairs, a drain into which water from machine may be emptied and a water softener. This equipment makes washing a pleasure.

In this laundry a large cupboard contains the canned fruits and vegetables.

In the furnace room and on the back of the built-in buffet are shelves on which nails and tools are kept. The chimney has three flues: one for the furnace and laundry stove, one for the fireplace, and the third an incinerator which was built into the chimney by using an old furnace front and grates.

In this room the Oil-O-Matic oil burner attached to the boiler takes only a few feet of space, contrary to the basement where considerable space is needed for coal bin and kindling.

The garage is 11 feet by 19 feet with three windows and triple inward-folding glazed doors. The driveway leading down is 10 feet wide with a drop of 4 feet to 20 feet.

We find this a wonderfully comfortable and convenient home which is admired by many.

Congratulations

to "Science and Invention"

for its

BASEMENT IMPROVEMENT CONTEST

and to the owners of Williams Oil-O-Matic oil burners who won $230 out of the $400 prizes!

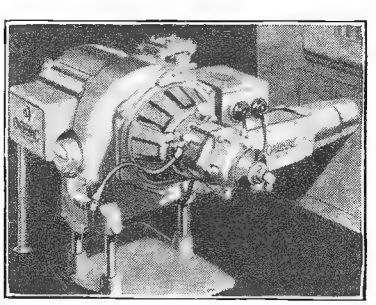
THE recent Basement Improvement Contest conducted by *Science and Invention*, makes this magazine more interesting by making it more helpful to its readers. This contest focused attention on the neglected third of every house—the basement. Read the different ways home owners have made their basements into a usable floor without extra building cost.

It is significant that $230 of the $400 in prizes—the first three awards and three others—in this contest were won by home owners who had installed Williams Oil-O-Matic oil burners. With Williams automatic oil heating, dirty coal and dusty ashes are eliminated. The basement of an Oil-O-Matically heated home is as clean and can be made as inviting as any other floor. Read below why this greatest modern improvement—healthful Oil-O-Matic warmth—costs little more per year than old-fashioned, wasteful hand-firing of bulky fuel.

Williams Oil-O-Matic announces the greatest improvement since oil heating was invented

THE *DIFFUSOR*

NEW quietness and new economy are made possible by this new Oil-O-Matic Diffusor which is built into this low priced Williams burner. Important as it is, this latest improvement is only one of many exclusive, money-saving advantages of Williams fuel oil heating. See the Oil-O-Matic dealer in your city today or mail the coupon below for more interesting information. Learn why Oil-O-Matic was the choice of far more home owners than any other burner in the world! Mail the coupon *now*.



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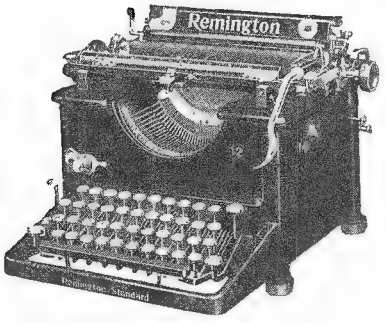

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The Right Diet for Your Outboard

(*Continued from page* 504)

However you use at your own peril. Lubricating oils are many and good. Nearly every motor manufacturer specifies the oil to use with his particular machine. There is not much to say on this score except that it is vital to mix oils and lubricants extremely well before placing them in the tank.

Don't use too heavy an oil. When your motor first starts, an extremely heavy oil will not be carried to all parts and the pistons will have to make a hundred or two absolutely dry strokes and you can readily imagine what that will do to the finely honed and balanced cylinder walls and pistons. Castor oils should never be placed in a two-cycle engine, it just will not mix with the gasoline and is so heavy that it is useless anyhow. A heavy oil is also hard to suck through the needle valve. It also gathers in the bottom of the carburetor bowl and then will often clog the float, needle valve or what have you.

Too light an oil will not function at all except at the very start. As soon as the motor heats up it will thin to the point where it will be useless as a lubricant. Therefore stick to the oil recommended by makers and you will not have much to worry about.

The "hopping up" of outboard engines has long been a fetish with many. Why, I cannot understand. Nevertheless, I have, right now, nearly a score of letters from SCIENCE AND INVENTION readers asking me for formulas for speeding up motors that already turn up from 3,500 R.P.Ms, to 5,000 R.P.Ms!

Dear Outboard Enthusiasts—for the love of mud! *Don't* try to hop up your motor. You will win many more races if you will learn how to utilize the abundance of power already at your command.

Volumes have been written on how to make an outboard turn faster. Such sterling drivers as Dick and Malcolm Pope, Andy Kerr, Earl Gresh, Jim Smith, Harold Chapman and others, all will fervently tell you that they have "hopped up" their motors, yet I have raced in competition with all of these prize winners and have never yet seen one of their motors turn faster than mine, which is a strictly stock motor in every sense of the word!

Of course, it helps if you smooth with emery paper all inside surfaces to air intakes, thereby eliminating skin friction and allowing more air to flow into the chamber. It also helps to check each moving part on each side of the motor and be sure it weighs exactly the same as its corresponding part on the opposite side of the shaft, thus assuring perfect balance and a few more revolutions.

I have heard that it helps to smooth all outside surfaces with emery paper to make them slip through the water easier, and I have known experts to cut crank cases twenty-one-thousands of an inch to increase compression, and have also seen gaskets sealed with shellac or removed entirely, and the heads bolted tightly to the jackets by main force.

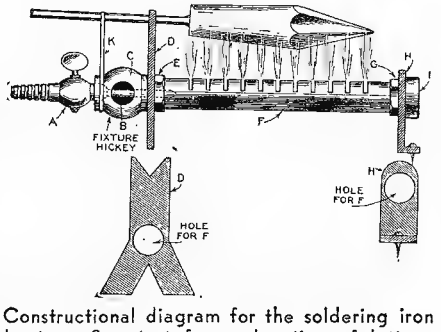
All these things undoubtedly help, but the resulting increase in revolutions hardly pays for the expense and labor involved and there is no question about these things weakening structural strength—which means that some day, in the midst of a championship race, there will be a breakage somewhere, and the chap with the good old dependable motor that always runs (never having been tampered with) will cop the prize while you shake your head ruefully and curse with all the vehemence of a cavalryman!

In short, be sure you are right and then DON'T EXPERIMENT IN FUELS, LUBRICATING OILS, OR HOPPING-UP METHODS. At Trenton, New Jersey, last 4th of July, my Johnson 32 racer on a Fairchild Aero Hull, turned up 5,800 revolutions without any hopping up. It never will have, either! And I'll win a race or two more before I quit! My advice is, "Go thou and do likewise!" Next month—"How to form an outboard club and how to hold a regatta."

A Soldering Iron Heater

By John Remonte

ANYONE with a hack-saw and a pair of pliers can make a handy soldering iron heater that will do quick heating and will cost very little. All that is required is one gas cock, one ⅜" fixture hickey, three inches of ¼" copper tubing, two ⅜" locknuts, one piece of ⅜" pipe six inches long, two small pieces 16-gauge sheet iron, and one ⅜" pipe cap. The copper tubing is soldered on the end of the gas cock which is cut off long enough to go about one inch beyond the air opening into the pipe. The burner proper is a piece of ⅜" pipe that has been slotted every half inch and the legs are two pieces of galvanized iron, and a wire hook, K, is wound around the gas cock to hold the soldering iron.



Constructional diagram for the soldering iron heater. See text for explanation of letters.

Follow the instructions below. You need a few gas and electrical fittings and two pieces of 16-gauge galvanized iron. A is a ⅜" male gas cock into which is soldered a piece of copper tubing, B, two inches long and flattened on one end. C is a ⅜×⅜" female fixture hickey used because it has hole openings to permit air to mix with the gas entering the burner. D is another piece of ordinary galvanized iron, 16 gauge, cut so as to form legs and a rest for the soldering iron, and holds it in position firmly. F is a piece of ⅜" gas pipe about six inches long into which are sawed about one-half through, with an ordinary hack-saw, slots approximately half an inch apart through nearly the entire length. G is another locknut which holds the front feet, H, in place and I is a ⅜" cap which stops up the end of the burner. This burner will make a blue flame with plenty of force to heat the soldering iron quickly, takes up little space, and the biggest cost item is the gas cock which can be bought for twenty-five cents.

When Broadway Went Up

(*Continued from page* 498)

span with a single wire a distance of more than 11,000 miles.

The instant the explosion occurred the nearby central offices of the telephone company were aware that a disaster had taken place. Operators were unable to clear the distress signal lights and calls to a large number of central offices in the metropolitan area could not be completed. The telephone repair forces swung into immediate action.

This was the worst job the repairmen had ever tackled, for nothing comparable to the disaster had ever happened in telephone history except the similar fire which raged underground in the rapid transit subway excavation at 8th Avenue and 36th Street three years ago. The havoc caused by that fire involved a greater number of damaged circuits, but in all only 8,400 feet of cable was destroyed. The 8th Avenue fire was in an open cut and the damage concentrated, whereas the Broadway explosions, involving a wider area, necessitated considerably more splicing and put working space in manholes at a premium.

From Thursday, April 3rd, when the explosion occurred, until the next Tuesday, action continued at fever heat along the Broadway firing line. Thirty-four splicing teams were on duty during the day and thirty-four at night, working in twelve-hour shifts to mend the broken circuits. The first job was to restore service by temporary wiring for the most important circuits, including police signal and fire alarm boxes, until the regular facilities could be restored. Meanwhile special wiring and operations were made at the central offices in rerouting calls around the affected areas. The temporary repair work relieved congestion within a few hours after the explosion, and a considerable portion of the normal calls were going through between affected sections, with slight delay, by Friday morning.

At the scene of the disaster some fifty reels of new cable shipped by emergency orders and lined on each side of Broadway were unwound one by one into the manholes to replace the damaged cables which were being pulled out of the underground ducts.

The main task of restoring service was completed by Tuesday, April 8, just five and a half days after the explosion. On that day all subscribers' lines were in working order and the hum of business throughout the section was again at normal.

$5,000 FOR PERPETUAL MOTION

The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore, the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

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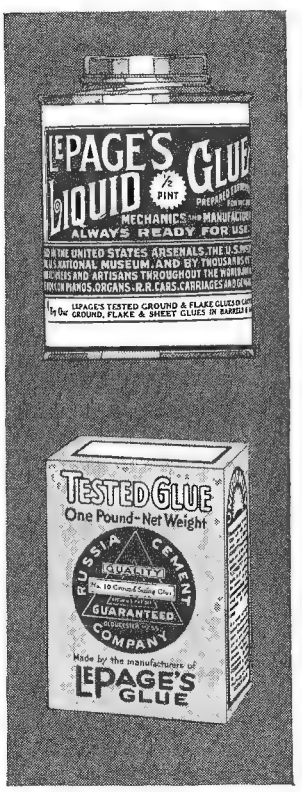

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A Lathe of Wood

(*Continued from page* 517)

are made from pieces of hard oak, birch, or dogwood—preferably oak or birch, as the pieces may be purchased cut and dressed at the lumber mill. The pieces are cut 2 inches by 2½ inches and as long as the headstock pieces. They are ripped 1¼ inches from the top and the ripped surfaces dressed square. The bolts that hold the halves together are put in and tightened. Now the mid-point on line between the halves is punched and a ½-inch hole drilled through, care being taken to hold the bit perfectly straight. After this a hole is drilled and countersunk in each end of the lower piece of each bearing to take a ⅜-inch machine bolt. Next the bearings are placed on their respective standards, A and B, so that the lower part of each will be flush at the end and top surfaces with its standard; then they are clamped and the holes at each end used as guides for drilling through the standards for the ⅜-inch bolts that hold the bearings in place. B, in Figure 3, shows the method of countersinking these holes. If the laying off of the headstock standards, the bearings, the spindle holes and the execution of this part of the construction is done carefully, splendid performance of the machine is practically insured. Having the headstock spindle-holes in line and the bearings securely fastened guarantees a smooth-running spindle.

A hole ¼-inch or a little larger is drilled immediately over the spindle hole on the top of each bearing down to within about 3/32-inch or ⅛-inch of the hole with a machine drill if procurable; then a 1/16-inch hole is drilled from the center of the larger one down into the spindle-hole, thus providing a reservoir and slow feed for the oil.

The Rests and Tailstock

Very little need be said concerning the rests. They are made from material 1¼-inch thick, about 10 inches long, and 6 inches high; the back edge is beveled as indicated. C is used in turning ordinary objects: chair legs, etc.; while E is expressly made to use in faceplate turning, such as lamp bases, picture frames, and so on. Pine may be used in the construction of these, but oak will give better service.

The tailstock, D, is made in much the same manner as the headstock standards—considerable care being used throughout, especially in laying out and drilling the hole for the spindle tube. The top of D should be five or six inches higher than shown until the ⅝-inch hole is drilled and the internally threaded spindle-tube of the same outside diameter is forced in, thus preventing splitting. The inside diameter of this tube is about ⅜-inch and is threaded to take a ⅜-inch threaded crank spindle; a locknut is also provided—see Figure 2. This spindle and the tube into which it fits will have to be made by a machinist. The spindle center is ground to about a 45 degree conical point.

The headstock spindle is likewise made by a machinist and must be turned to the dimensions given. Cold rolled steel makes a splendid spindle. The pulley may be made of walnut or other hardwood and attached by driving on over a pin through the spindle as in Figure 3; or it may be made of cast iron and secured to the spindle by a headless setscrew protruding into a hole in the spindle—this method is usually preferable and is more lasting, though generally more expensive. The threads on the spindle are No. 12 machine cut.

The spur center is made of cold rolled steel with four spurs 5/16-inch long and ⅛-inch wide at the base. The center point is a fraction over ⅛-inch in diameter at the base and 7/16-inch long. The spur center is preferably a solid piece. It is, of course, machine-threaded to fit on the spindle, as also are the chuck piece and screw-plate blank described below.

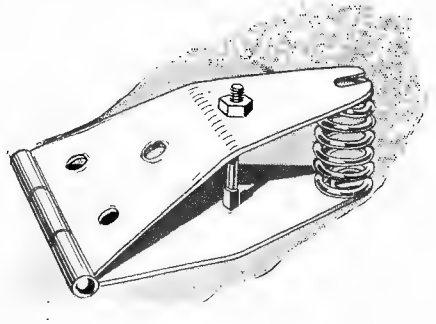
The spindle should fit the bearings nicely; if it does not fit snugly, due to some inaccuracy in construction, the bearing may be gouged out a little on the high points or the standard shifted by dressing off a little on one side of the neck and setting over. This phase of the work is left to the skill of the builder. The spindle can scarcely be expected to fit perfectly at first; but after the bearings have become thoroughly oil-soaked, a few paper shims have been put between them and they have been worn-in, as an automobile engine is limbered up, the smooth, chatterless running that results will delight the heart of the owner.

The screw-plate blank is made of cast iron and should not exceed a cost of one dollar. The wooden disk into which the blank is screwed should be birch or fine grain oak and may be any diameter up to eleven inches—it is shown 5½ inches. The hole for the screw is drilled on the lathe to insure centrality. An ordinary woodscrew is used; it should make a tight fit in the hole. A No. 10 screw is about right for most work. The chuck piece needs no description except that it is necessarily made of steel and is counted a luxury.

A ¼ H.P. or 1/3 H.P. motor with a 1¾ inches by 2 inches wide pulley is an ideal power unit unless the builder is lucky enough to have wind or water power at his command. The belief of many is that wooden bearings will not last; the writer has seen a set of oak bearings on a 3-inch capacity auger and a set of dogwood bearings on a 5 H.P. lathe that are better now than the day they were made twenty-four years ago.

Easily Made Spring Compressing Tool

TAKE an old strap hinge, drill, file and cut a square hole in one leaf for the shank of a carriage bolt and drill a round hole for the other end of the bolt in the



other leaf. Cut a slot in each end for the valve to slip through if it is to be used for automobile valves. By placing the carriage bolt and nut in place and turning down the nut the spring will be easily compressed.—*Joseph D. Ambrose.*

Basement Plan Prize Awards

(*Continued from page* 519)

two-thirds of the entire area. One which leads off this is used as a laundry room and contains an automatic hot water heater, the compressor which refrigerates the inbuilt cabinet in the kitchen, and other equipment such as the washing machine and tubs. Another room leading off the main one contains the shower, toilet, and lavatory. The latter has chromium-plated fittings, and a Venetian mirror is mounted on the wall above it. Black fiber furniture with red trimming is used in the large room. Overstuffed red leather cushions are used wherever upholstering has been provided, to carry out the color scheme.

For lighting and other purposes there are seven double floor-plugs. At present three floor-lamps, two small table-lamps, two double ceiling-lamps, and one lamp on each side of the lower stair landing give adequate lighting which creates a cheerful atmosphere.

Basement Is Unit When Desired

One of the three radio plug-in sockets in the home is in the basement. The result of it all is that this spacious and comfortably-fitted room can be used for any living or entertainment purpose. Entrance is made through the kitchen which simplifies the problem of serving guests. When desired, however, the basement can be utilized as a room entirely distinct from the rest of the home. Two parties may be staged upstairs and down without conflict. For occasions such as this guests may enter the basement from an outside door without passing through any of the rooms above.

The smooth tile floor lends itself admirably to dancing, with musical accompaniment from a radio orchestra. The six-inch block tile is such that checkers, shuffle-board, and many other games can be played on it. Above all this, the basement is ideal for a child's playroom. While attractive, everything used in the furnishing of the basement is sturdy and durable. Best of all, this has been accomplished at a cost which is barely one-fourth that of the upstairs rooms. Everything points to more frequent use of this added room than any other in the home. Considered while the expense of the entire home is still fresh in my mind I would say that a thoroughly practical and economical result has been obtained.

Electric Flask Heater

A VERY satisfactory electric flask heater can be constructed of readily available materials at a cost of less than a dollar and a half. The diagram shows the construction.

It is made of two concentric cylinders of twenty-four gage sheet iron. These are separated by three or four layers of asbestos cloth or paper. It is held together by a few rivets or stove bolts. The clamp which holds it to a ring stand is a part of a burette clamp. The heater element screws into a porcelain lamp socket of the type used in radiant electric heaters. Their cost is fifty to seventy-five cents and power consumption is about 550 watts.

If the heater is to be used to warm a flask or to boil very volatile liquids a light bulb may be substituted for the heating element.—*R. D. Black.*

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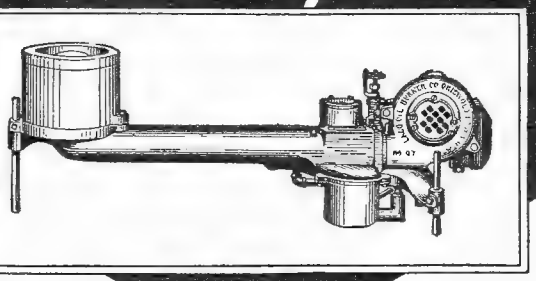

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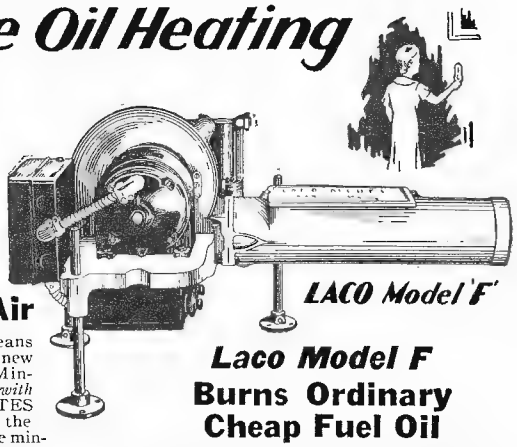
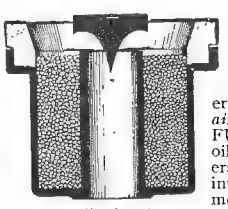


LACO Model 'F'

New Invention Burns Oil With Air



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PATENT ADVICE

CONDUCTED BY JOSEPH H. KRAUS

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail, a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

Home Phono Recorder

(1233) C. Hastings Abel, Walnut Creek, Calif., asks:

What do you think of the idea of using an especially designed audio transformer to couple the power tubes of a radio to a phonographic pick-up and use the pick-up to record good radio selections on blank records?

A. 1. We have always felt that it would be a good idea for an individual to invent a system whereby he could make phonograph records at home, using the regular amplifying system in a radio set to amplify the voice and a magnetically operated stylus to record the voice on a phonograph record.

Many difficulties intervene. The idea of the amplification is not a very serious difficulty, but a means for guiding the needle across the record so that it will form its own grooves without one groove falling upon another, and a means for doing this in a very simple way, and a method for producing a record that will be as permanent as it is humanly possible to produce such a record, are all necessary and most difficulties all be overcome. We would suggest that if you intend to carry on any developmental work along this line, you devote your time and energy to the method of guiding your needle across, attachable to any phonograph of course, and to the perfection of a record that will be practically permanent.

There is nothing patentable in the idea as you have suggested it. It is merely an idea that has been tried heretofore and that has actually been installed on the market in one of various forms. Unfortunately, we do not today know of any device with which one can make his own home records. There is not much doubt but that you could secure a patent on the suggestion after it is fully developed. We wish you the best of success.

Applying for a Patent

(1234) J. I. Sands, Las Vegas, N. Mex., wants to know the proper and safest way to make an application for a patent.

A. 1. It is always suggested that as many priority claims as possible be built up by the inventor. Any way of definitely establishing a date of conception, is always a good suggestion; such as taking a description of the idea to a notary and having him affix his seal, filling out the conception blanks furnished by patent attorneys, mailing descriptions of the invention to yourself in a registered self-addressed letter and keeping that letter on file without opening the same or and showing the idea to friends and having them testify to the date when they saw the same. A reputable patent attorney will never "steal" an idea from his client.

We will vouch for any attorney advertising in the columns of this publication. We have taken the trouble to investigate all of them.

Another Invention Gone Wrong

(1235) A. Aronson, Pasqua, Sask., Canada, submits a copy of patent No. 1,621,822, issued to him on March 22nd, 1927, which relates to improvements in butter molds. The molds are to deliver print butter.

A. We would like very much to help you dispose of your invention. Unfortunately, we do not know how we could possibly aid you in disposing of a suggestion that on its very face presents but little value.

You have designed a butter mold to assist in dispensing butter. This mold, according to the specifications, contains approximately one pound. Now just exactly what is the operation needed in measuring out one pound of butter? First, the mold must be filled. In order to do this the store manager will have to lift individual slabs of butter out of the tub and press them down into a mold, much the same as a person filling a dispenser of ice cream for the making of ice-cream sandwiches. But the butter is a good deal more firm than ice cream. It is impossible to press it into the mold properly, and the effort seems to us to be quite useless.

After the mold is filled, the individual dispensing the butter, must force the butter out of the mold and place it on a scale so as to weigh it. Air spaces will occur which change the weight, and therefore, you will have to add to the quantity of butter an extra slab or two from the tub. Furthermore, the material coming out of the mold presents an unsightly appearance. It is not nearly as good looking as even individual slabs scaled off and laid down, one on top of the other in the regulation cardboard form, such as are used today in dispensing tub butter. After the operation, your mold must be cleaned, otherwise the butter remaining therein would become rancid and spoil any added quantity.

We wonder where you saw any advantages to a device of this general class at the time you patented it. Had you come to us for information before you secured said patent, we would have advised against further procedure. If you can suggest, any way in which we could help dispose of this idea, please feel free to do so. Any offer, regardless of how small, should be accepted by you.

PATENTS

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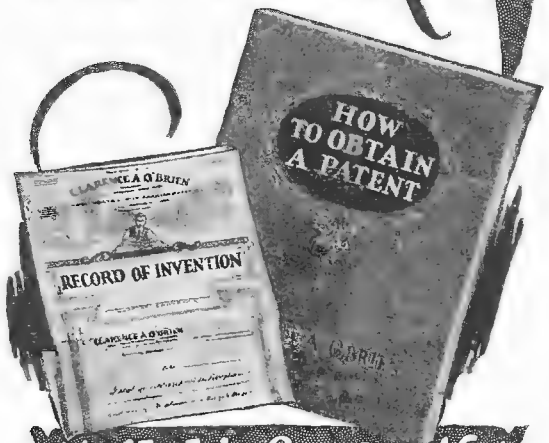

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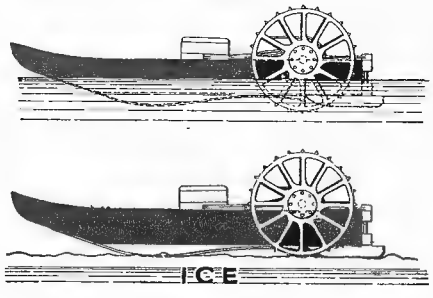
Combination Water and Ice Boat

No. 1,761,440, issued to Joseph Brost

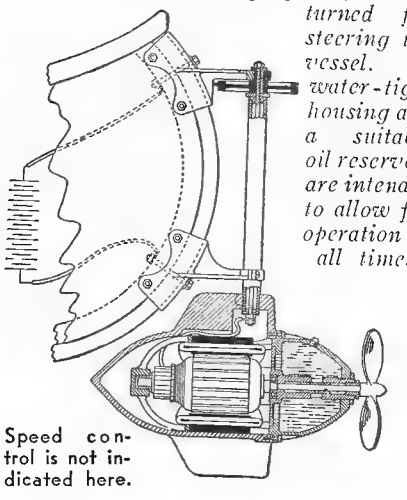
THIS combination water and ice boat has a propelling means that is equally effective either in water or on an icy surface, and that will cause the boat to rise out of the former and climb upon the latter should such an effect become necessary. The rudder is so arranged that the boat can be efficiently steered on ice or in water by the same arrangement. The wheels on either side are provided with a series of vanes or paddles, which take care of the vessel when in the water. The drive is accomplished through a worm meshing with a gear mounted on the wheel. The axle of the wheel passes through bearings attached to springs and the motor is free to rock up and down. This prevents accidental damage to the wheels.



Electric Outboard Motor

No. 1,764,388, issued to Conrad R. Buchet

HERE is one of the very first electric outboard motors that have so far been designed. The motor will be operated by storage batteries contained within the boat. The motor is contained in a water-tight housing, and is mounted on an upright column so that the entire motor, as well as the propeller, can be turned for steering the vessel. A water-tight housing and a suitable oil reservoir are intended to allow for operation at all times.

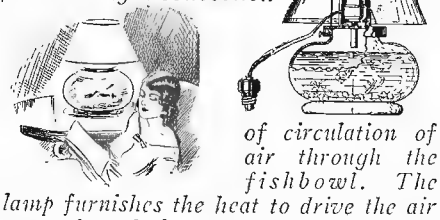


Speed control is not indicated here.

Combination Fishbowl and Lamp

No. 1,762,634, issued to Motogo Jyumi.

THIS is an ornamental article comprising a fishbowl and a lamp in unitary association. A means is also provided for insuring a convection

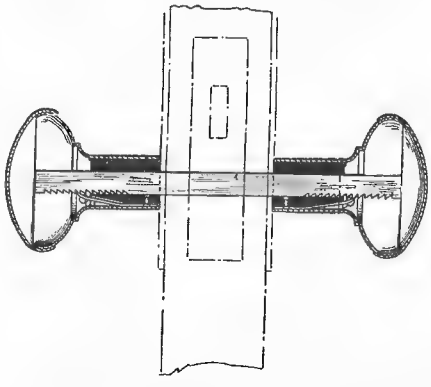


of circulation of air through the fishbowl. The lamp furnishes the heat to drive the air upward, and the construction is so arranged that the colder air must pass down over the surface of the water in the fishbowl. When the lamp is illuminated, it serves not only as a utility light, but also enhances the effect presented by any room in which such a lamp will be found, when the light is reflected from the golden backs of the fish contained within a bowl.

Door Knob

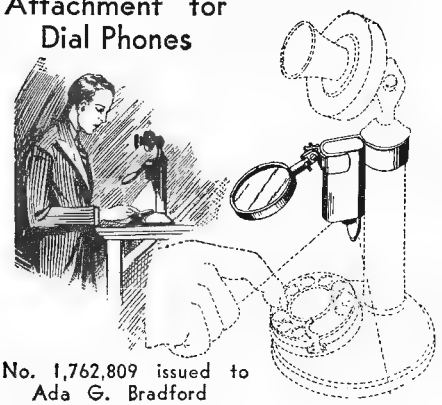
No. 1,734,520, issued to Albert F. Hazelwood.

EVERYONE knows the difficulty with the average door knob in that it cannot be made to properly fit the door. The present constructions have screws and spring washers or other complicated devices which allow for a certain adjustment, but this is always between more or less wide limits. In the present plan, we see a door knob that can be easily and quickly applied to



the stem or removed therefrom without the aid of complicated devices, and that is of such a character as to be instantly adjustable to any thickness of door and that will be held positively against accidental disengagement. As can be observed in the illustration, the stem is provided with teeth and the door knob is fitted with a spring which engages these teeth and holds it in position.

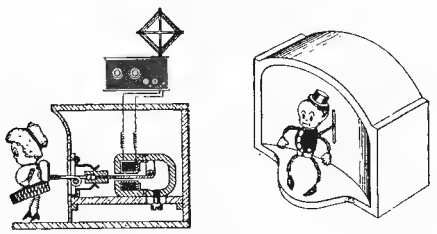
Magnifying Glass and Light Attachment for Dial Phones



No. 1,762,809 issued to Ada G. Bradford

HERE is a unique attachment for an ordinary dial telephone which provides a flash light to illuminate the dial and a magnifying glass to help with the reading of the characters. The article is of a very simple construction and makes use of one of the popular flashlights now found on the American market. The device is intended to snap right on the ordinary dial telephone, and occupies such a small space that it will not interfere with the free operation of the dial.

Radio-Actuated Figure Toy



No. 1,726,294, issued to Lloyd C. Greene

THIS is a little figure toy that may soon find its way into the American market. It is a small electro-magnetically vibrated figure that receives energy for its dancing from any radio set capable of operating a loud speaker. As the illustration depicts, the mechanism for agitating the figure in time with the music is substantially the same as that found in the average magnetic type of loud speaker. The front wall of the cabinet is made of a comparatively thin, vibratile material which acts as a sounding board, and reproduces the radio music transmitted by the pulsating current passing through the electro magnets. In order to set up these sound-producing vibrations in this diaphragm, a light spring of phosphor-bronze wire rigidly attached to the wall is allowed to rest lightly against the side of the supporting bar.

Save Up Your Tin

Is the Subject of an Article on How to Reclaim the Plating from Old Tin Cans, to be Published in an Early Issue

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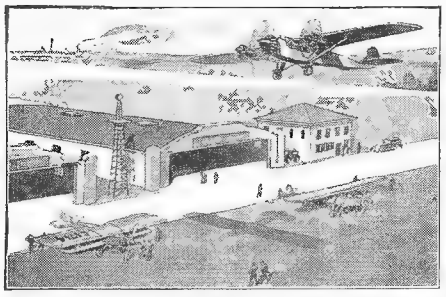

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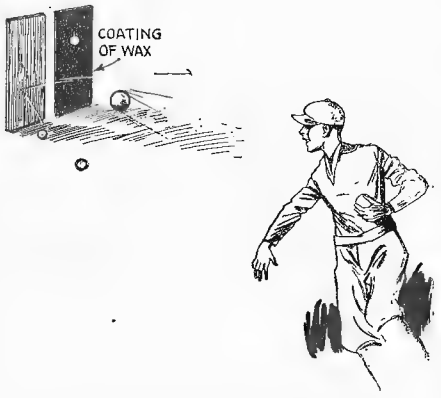
Scientific Problems and Puzzles

By Ernest K. Chapin

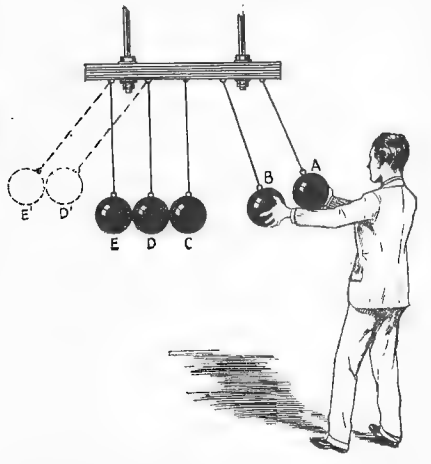
A Waxed Board and a Ball

STAND two similar boards up on any flat surface. Wax the face of one. If you throw a ball at the latter, it will stick to the wax; it will rebound readily from the unwaxed board. Which board can be overthrown by the impact of the ball first?



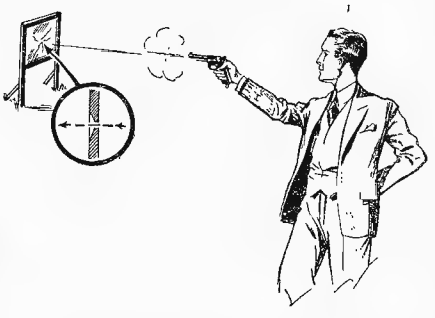
A Ball's Impact

STEEL balls A and B strike stationary balls C, D, and E, which are touching. Balls D and E will be knocked into positions D'E'; C will remain undisturbed. Replace A and B by a single ball of equal weight. Would the effect be the same on C, D, and E?



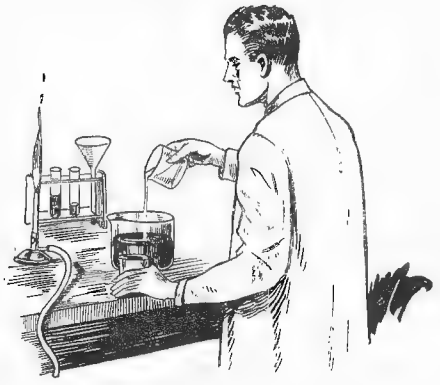
Where Does the Bullet Come From?

A FAST flying bullet will leave a conical-shaped hole in passing through a plate glass window. From an inspection of this hole, can you tell from what side the bullet was fired?



Washing with Alcohol

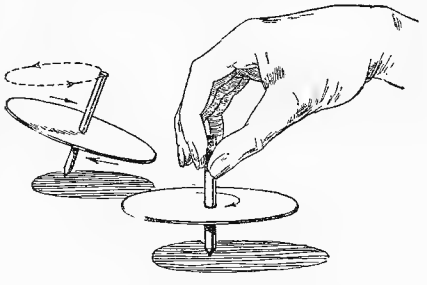
A SMALL quantity of a fine precipitate is contained in a beaker. You are to wash this precipitate in alcohol to remove impurities soluble in alcohol. You have a choice of washing twice



with 100 cc of alcohol each time, or three times with 30 cc each time. Assuming that one cc of alcohol adheres to the precipitate as a result of each washing, which method would remove more impure matter?

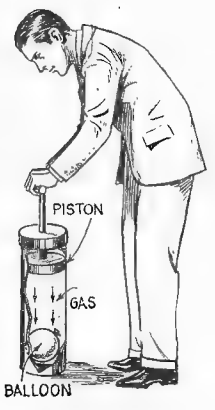
When a Top Spins

SPIN a top in a clockwise direction. If you watch it closely, when its edge strikes the surface upon which it is spinning, the clockwise direction will appear to be reversed to a counterclockwise one. The surface, then, may be said to act like a brake on the motion of the top. Why doesn't the spinning stop, instead of merely being reversed?



Will a Balloon Rise?

WILL a balloon move upward to meet compressed gas? You have a balloon, just heavy enough to sink when the piston of the cylinder of gas (in which the balloon has been placed) is at the top of the cylinder. The volume of the balloon remains practically unchanged while the piston slowly descends, compressing the gas. What is the balloon's reaction?



Solutions to these problems and puzzles will be found on page 556

Psychologize as You Go

By Edward J. Beck

You can saunter down a business street and pick up a little side-light on human nature in almost every shop and office.

At the soda fountain luncheonette, the boss white-jacket had remarked that ham was still the most popular sandwich. When asked why he responded, as if it were the most obvious fact in the world: "It's ham because that's a three-letter word and it's the easiest to say. People, unconsciously I suppose, save their energy by ordering things with the shortest name."

The bright young man behind a barricade of magazines at the union depot newsstand had just remarked that his biggest call was for magazines with the same old stories in them. And from that his mind jumped to a little investigation he once made which convinced him, he said, that the public was not strong in originality.

"I have a chance to hear a lot of goodbys here and so, just for curiosity, I once kept tabs on what was said," he recalled. "I should say at least 80 percent consisted of one of four phrases: 'Be good'; 'Take care of yourself'; 'Don't forget to write' and 'Don't take any wooden nickels'."

Persons who meet the public day after day in some one capacity, whose calling gives them a strategic knot-hole for viewing the game the rest of us play, are not only able to enlighten you as to some of the peculiar things people do. They can also take you behind the scenes and then reveal the tricks whereby people are made to do things.

We have space for only one example of such manipulation of human nature. Companies operating street cars want to keep the entrances and exits of their conveyances clear. They want to "shoo" the customers down to the midsection.

But how? Well, signs might be plastered around: "Please move to center of car." Some companies still do that. Their signs are a poor prod to human inertia.

Some clever observer of human nature noticed that people do not like to sit on lengthwise benches as long as crosswise seats are available. It is uncomfortable to sway back and forth like a pendulum. By installing lengthwise seats near the doors, the companies automatically induce the passengers to vacate the ends of the cars. This little observation has not only saved a lot of human breath and printer's ink but made certain a surefire response.

Another psychological slant concerns the type of car known as the Peter Witt, after its inventor. The Peter Witt car is entered at the front and discharges through doors in the middle. Passengers still show a certain unwillingness to move back into the blind end of the car, due probably to some remnant of the unconscious fear all living things have of being trapped.

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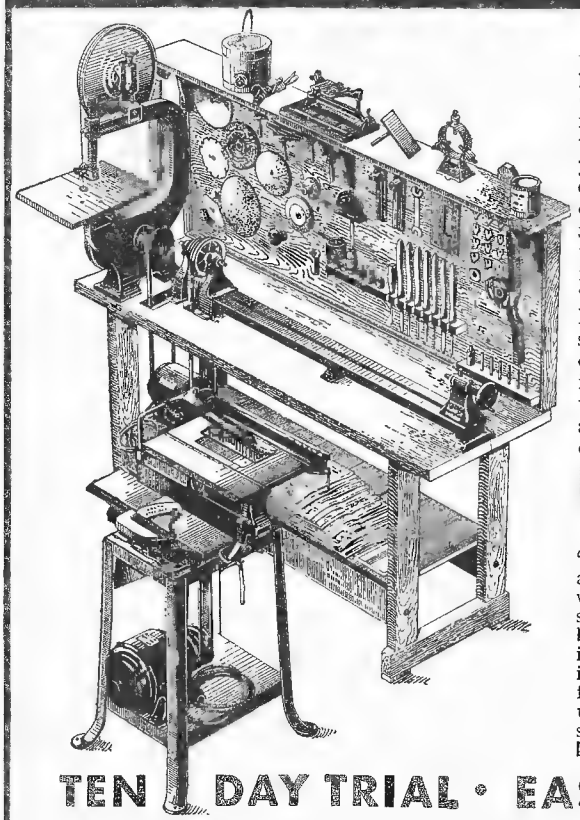

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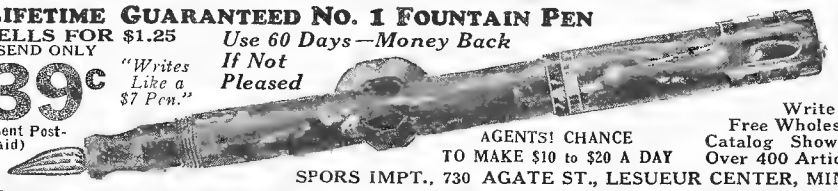

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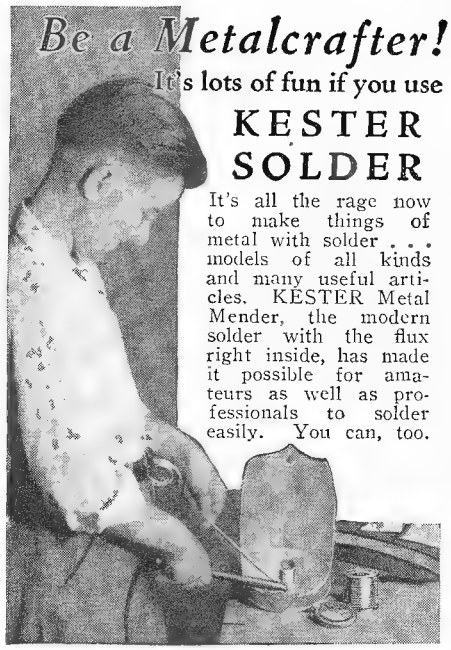
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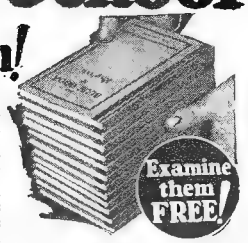

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Hunting Sharks for Meat, Shoes and Vitamins

(*Continued from page* 495)

sharks are drowned when they are caught in these nets, so thoroughly tangled are they from fins to tail.

But not all of the catch is hauled up, ready for commercial exploitation. Not infrequently the gray nurse—a long, sinister creature which fights every inch of the way—is discovered. With a long roll and a small open boat, plus such a creature, all just outside the line of breakers, is warranted enough to thrill the most blasé. In his death throes, such a monster lashes out in deadly fashion.

For the smaller game a pistol generally ends the struggle, but a giant tiger—fourteen feet long—sometimes refuses to give in and will battle for an hour or so while the crew lashes him down. A "fish" (for such the crew call their whole catch) weighing 900 pounds dead weight, in a choppy sea, is a matter to be handled with tact!

Sometimes a whale decides to play within the net, and then there is trouble a-plenty.

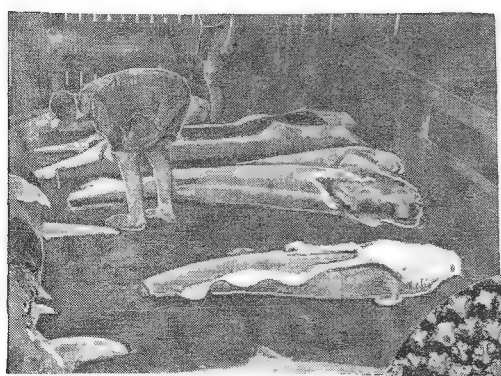
"One of these days," exclaimed a sleepy member of the crew operating in the Pacific, "we are going to have plenty of fun trying to handle a whale!"

The very next morning there was an upheaval in the nets and the boat closed in to investigate. A huge black mass rose alongside, and accounts of the next few minutes are hazy and confused. The creature was well entangled and the harpooner emptied the pistol used for dispatching sharks.

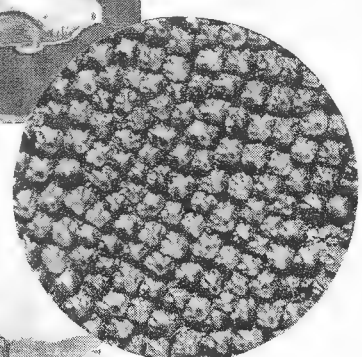
What happened was a-plenty—and sudden. The huge beast stood on its head, the great tail in the air and the big flukes smashed down on the water within a foot or two of the boat. It was a close call and might have been the end had it not occurred to one of the crew to start the engine and run. Since then this crew has been on the lookout for other queer customers. Whales are simply not wanted in the new shark nets.

The shark, long feared, has found its match in the long, tough nets. These are laid to lie loose, thus giving considerable play. A shark swims into it, usually at night, and a mesh is forced over its snout like a noose, which its impetus makes very tight. Alarmed by the trap into which its head has become jammed, it endeavors frantically to free itself and becomes effectively tangled by the fins and frequently, in the case of gray nurses, by the teeth also.

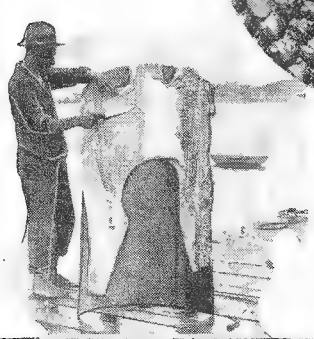
When the crew reach their nets, the buoy attached to one end is lifted onto the boat and the net raised by hauling in the rope, connecting the buoy to the extremity of the net. The buoy is then thrown back into the water and the line with floats attached is hauled to the boat until the other end of the net is reached, each portion after examination falling back into the water and to its position on the bottom. During this time the boat is hauled from end to end of the net.



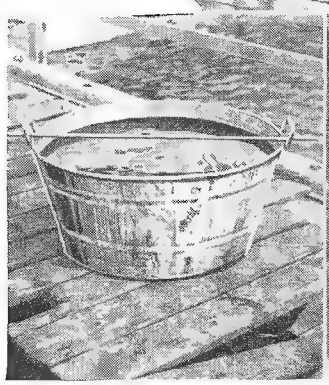
After the fins are removed, the skin is slit down the back and around the gills at the rear, preparatory to stripping.

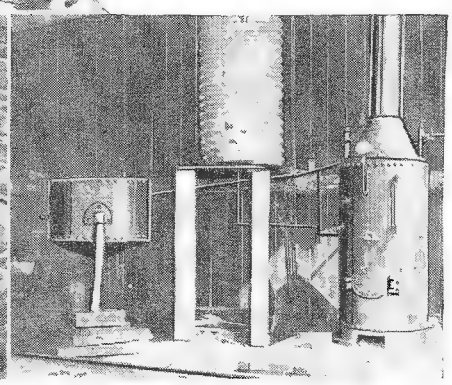


The denticles on the skin of a carpet shark; these must be removed before the skin can be tanned.



Cutting away attached flesh from a shark skin to prepare it for tanning.





Left — The plant for extracting the oil from shark livers; livers placed in steam kettle at left . . . and a tub containing eighteen gallons of oil extracted from a single tiger shark liver.

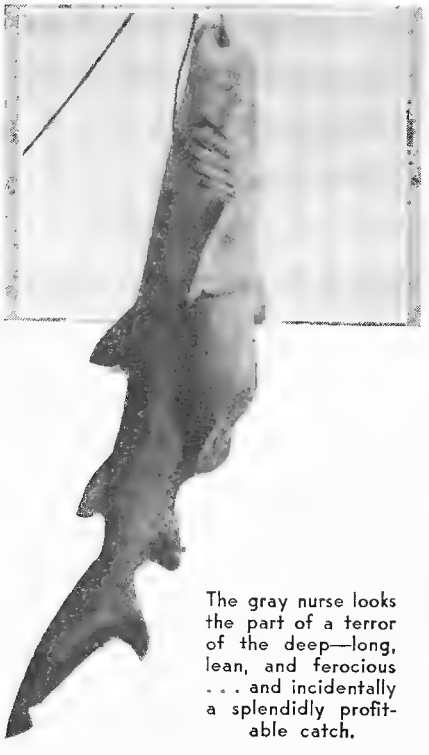
When a shark is sighted the net is dragged upwards until the shark's head is above the surface of the water; a large hook suspended from the derrick is then thrust into its jaws and it is dispatched by heavy blows of a club on the back of the head, or by a revolver bullet through the brain. The net is then disentangled and the shark stored in the hold or on deck.

Reaching the docks with from six to eight sharks the cutting up at once begins. The fins are removed, then dried in the sun, or in patent dehydrators. They are exported to the East for conversion into soup or gelatine. A ton of mixed sharks yields about twenty pounds of dried fin. The Chinese in San Francisco use the term *yu chee* for shark fins. To prepare the fins for use they are soaked in water for two or three days, when the gelatinous rays separate out and are then prepared and served in chicken broth, making a dish that is much relished by the Orientals.

Next the skin is stripped from the carcass. This is done by chopping off the tail and slitting the hide down the back and round the body, and by using a hand winch and clamps the skin is stripped from the body. The detached hide is now placed on a beaming board, a curved, upright iron stand and the adhering flesh trimmed off with a sharp knife. The hide is then washed and placed in a strong brine awaiting the tanner's skill.

The skin of the shark is covered with minute, dense denticles and these are removed during tanning. This is done with hydrochloric acid and salt. The actual tanning does not present any great difficulties and produces a leather that is very tough and durable. A ton of shark yields about 90 square feet of leather.

The flesh of the shark is cut into strips a foot long, soaked in brine and hung in dehydrators at a temperature of 130 degrees F.; it is ready for shipment in twenty hours. There is a great and growing demand for dried shark's flesh in the Far East and in Africa. The whaler shark has a golden color, the white shark reddish brown, and the tiger shark is coarse and gristly. A ton of shark gives about 180 pounds of dried meat.



The gray nurse looks the part of a terror of the deep—long, lean, and ferocious . . . and incidentally a splendidly profitable catch.

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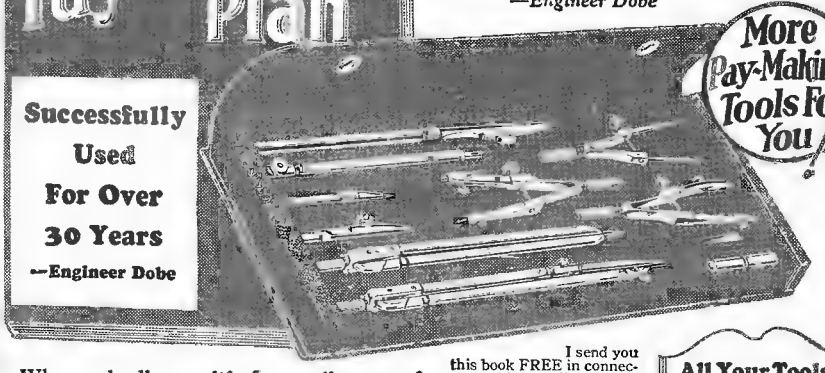

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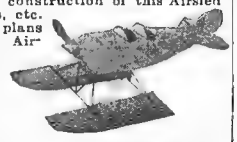

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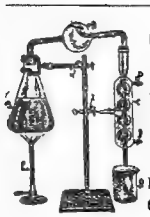

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But shark flesh does not need to be dried. The natives of the Near East and elsewhere like their shark flesh fresh. The meat to some is a bit strong, but is quite palatable when one is accustomed to eating it. The principal consumers are the Arabs, although the native Jews and Somalis also use it. The working classes, being poor, find shark meat a great boon because it is inexpensive.

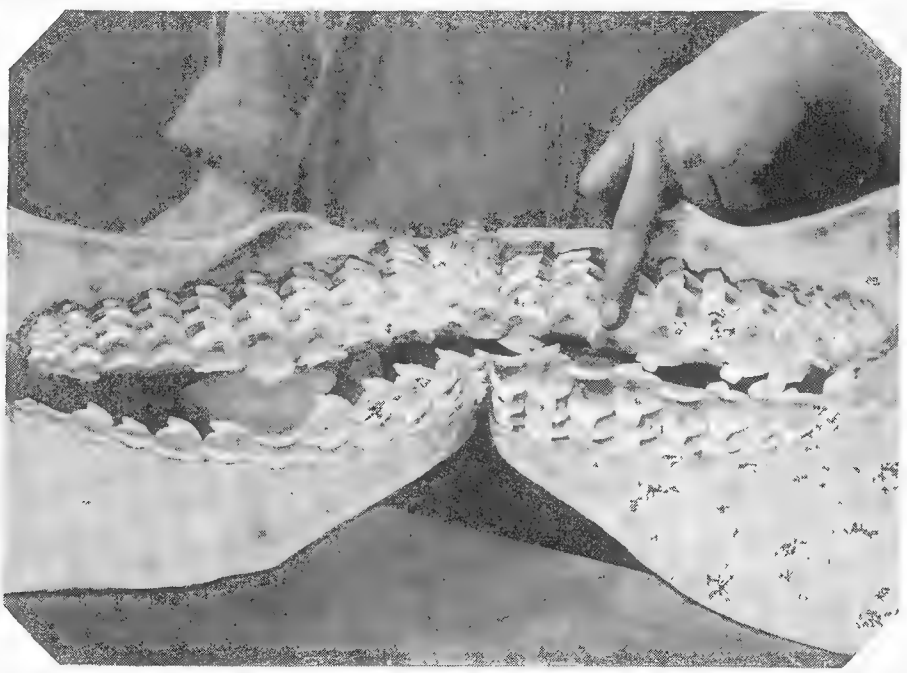
According to Dr. Allan Rogers, a prominent chemical engineer, who has been experimenting with shark fishing along the coast of Florida, "shark meat as a food is far superior to the average food fish. Its flesh is hard and firm, has a sweetish flavor and resembles halibut to a marked degree. Many who have eaten it are exceedingly fond of it and when one has overcome the natural prejudice against the shark he can find no better fish food than this somewhat despised and unpopular animal."

Besides the hide and flesh there are still other parts of the shark that find their uses commercially. In fact, there is very little of the shark that is not utilized in some way.

The most conspicuous feature of the shark is the liver. The liver of a thirteen-foot shark measures seven feet long and weighs 200 pounds. These shark livers are very rich in oil, it being extracted in a steam-jacketed kettle of fifty tons capacity. The types of oil vary according to the species of shark. Eighteen gallons of oil to a ton of shark is about the rule thus far established.

Babies, undernourished individuals, and others may soon, if they have not already, been told to take liver oil which may be from some tiger shark, since it is rich in vitamins A and D.

Other uses of the shark include fertilizer containing much nitrogen, stock food, poultry food. The teeth may be used as ornamental buttons and fancy goods. Glue, iodine and insulin are among other products taken from this monster of the deep.



Triple rows of teeth emphasize the dangerous character of the tiger shark . . . This specimen was taken in Australian waters, where the abundance of sharks is a constant peril to bathers—and a source of profit to the industry.

Captain G. R. Turner, veteran shark catcher of the Pacific, says that within 36 hours of capture the products of the shark are ready for market.

There is romance and more than a dash of adventure in this newest industry. It would be difficult to find a merrier crew than Captain Turner's or keener for their work. They are bold, game, sun and wind tanned, ready for a fight or a frolic with the water's most vicious creatures.

New Device Converts Coaches Into Sedans

IT will be unnecessary for the occupant of the front seat in a coach to get out of the car in order to allow passengers to enter or leave the rear seat when an "in-easy-out" attachment is installed on the folding seat.

Photo shows how the "in-easy-out" attachment faciliates entering and leaving a coach type motor car.

The "in-easy-out" is made of heavy gauge steel, has few moving parts, and is oiled by a special lubricating system. It is equipped with an automatic device which locks and unlocks the seat with the opening and closing of the door.

It is attached underneath the folding seat next to the driver. While it does not interfere with the tilting of the seat, this tilting becomes unnecessary because when passengers enter or leave the car from the rear seat the person sitting in the seat equipped with in-easy-out merely makes a slight turn towards the door without leaving the seat. It can be installed in fifteen minutes with tools which every motorist has in his kit. Motorists with small children will appreciate the convenience it adds to the safety of the sedan.

Flashes from the Radio Lab.

(*Continued from page* 521)

Condenser Alteration for Short Waves

WITH short-wave receivers which are not designed for operation solely on the narrow amateur bands, trouble is experienced in separating the various stations if a large tuning capacity is used. Of course, if the receiver was made simply for broadcast reception, a large condenser is recommended. But if the receiver is to be used on all of the amateur wavelengths, it is well to use a different capacity in the

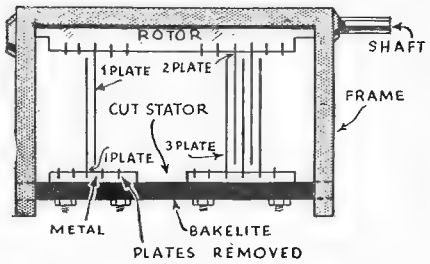


Fig. 4

tuning condenser each time we shift the frequency. Plug-in midget condensers have solved the problem but are unhandy and troublesome.

Secure a condenser with 23 plates in which the stator plates are mounted in such a manner that the one set of stator plates may be divided into two separate sets. These sets must not touch each other. For 1715 kcs., about seven plates are needed; for 3500 kcs., 5 plates; for 7000

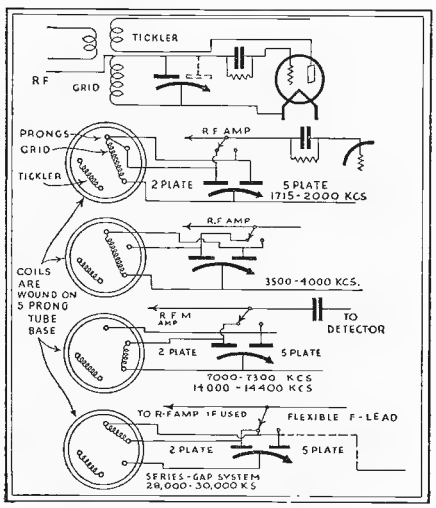


Fig. 5

kcs., 2 plates; for 14,000 kcs., 2 plates; for 28,000 kcs., series gap condenser. In order to secure the best capacity for each of these bands, pull out enough plates in each set of stators to have one left in the first set and three left in the other set. The rotor should not be separated but plates should be removed so that in the first condenser, there are two plates and in the second condenser there are five plates. (See Fig. 4.)

The connections for the various bands are shown in Fig. 5. A five-prong tube base is used for the coil form and five-prong socket is used. The condenser used at W9FTY is manufactured by the Walnart Electric Mfg. Co. of Chicago, Ill. The stator plates are embedded in one strip of metal which is fastened to a strip of

(*Continued on page* 569)

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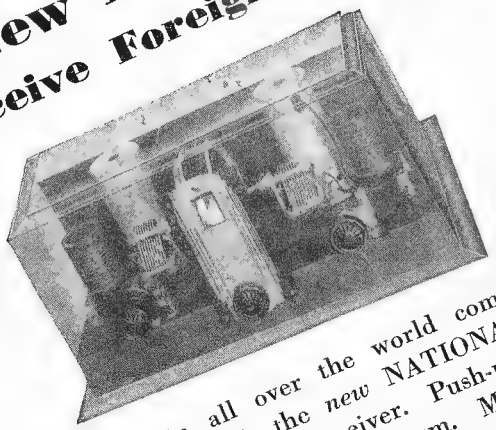

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Scientific Book Reviews

STUNT FLYING, by Captain Duncan (Richard—M. C.). Published by The Goodheart-Wilcox Co., Inc., Chicago; 183 pages. Price, $2.50.

In this book Captain Duncan takes up in a thorough fashion the technique of piloting a plane, from the first gingerly dual-control work to the most complicated and exhibitionistic maneuvers in the air. He considers the question of temperament, a point too often overlooked. The desire to fly, he makes plain, should be present in the student, or it is simply no go. And the patience and capacity for studying and understanding the individual must be present in the instructor, or it's no go, either. He is not out to encourage the Levine type of airman—the fellow who, to keep even with his ego, takes off in a ship that is alien to him and fights it into some crude sort of obedience—or gets washed out in the process. Yet, while he definitely rejects the do-or-die aviator, Captain Duncan offers the true aspirant a complete line-up of hints and helps, admirably ordered, and set off in boldface type, in the alert science of motorized, heavier-than-air flying. And he does not hesitate to stress the awkwardness and instability of the best heavier than-air machine, or to give the prospective pilot exact instructions on how to beat these thus far unavoidable characteristics. We (speaking personally) should be the last to deny that the most experienced pilot may crash on occasion; but we should also be the first to affirm that we would rather ride to a fall behind a pilot who had taken Captain Duncan's recommendations to heart than to fly on any other basis behind an airman of different training, regardless of the brilliance of his record. Captain Duncan devotes the final two chapters of his book to heavier-than-air ships that alight on water or on either water or land. We are pleased to note that he classifies planes in which fuselage and hull are combined as *flying boats*, and planes in which floats replace wheels as *seaplanes*. This differentiation is entirely in tune with our own ideas on the subject, and we believe that it also eliminates confusion and conforms to a common-sense view of the facts. The only outstanding defect in the book, as we see it, lies in the drawings, which in many cases are inadequate and in others useless. An airman as acute as Captain Duncan should be backed up with artwork at least fifty percent as effectual.

EXPERIMENTS WITH HANDWRITING, by Robert Saudek, published by William Morrow & Company, New York, 1930. Pages, 394; LXI; price, $5.00.

For twenty-six years Mr. Saudek has been doing research work in handwritings. While he admits that his findings have not progressed to the stage where he can treat "pathological features of handwriting from a single and definite point of view," he has gathered a great deal of information, which he carefully and systematically presents.

The author believes that character can be accurately told from handwriting. "All writing," he says, "is brain writing depending upon the visual memory, mood and character of the writer, rather than upon the mechanical act of setting down the words. But character is just one of the twelve factors involved in shaping handwriting. The mechanical means; the degree of graphic maturity; speed in writing; school copy from which we learned to write; nationality of the writer; his power of graphic expression; his imitative power; his cultural standing; his physiological condition; physical impediments; and finally, the position of the material under scrutiny in the text, all must be taken into consideration, he says.

To reach his conclusions Mr. Saudek has utilized slow motion cinematography, photomicrography, microscopic examinations, and other scientific instruments. He regards graphology as a science; he regards the consideration of handwritings as a thoroughly scientific study. We are sorry we do not agree with him in his views.

Should you desire to know just how you came to write as you do, and should you want to read a well written and interesting book giving all the principles of graphology, we certainly recommend this one. We particularly like the chapters on the signs of honesty and dishonesty, and the method to be followed in character analysis; also the glossary, and samples of handwriting in the back of the book.

MY AUTOMOBILE, ITS OPERATION, CARE, AND REPAIR, by Harold F. Blanchard, M.E. Second edition, revised. Published by the New York Scientific Book Corporation, 15 E. 26th St., N. Y. City. Pages, XIV; 373; price, $3.50.

This book is just what it is intended to be; a clear and simple exposition of your automobile, its parts, their care and operation. It has very many illustrations, which add lucidly to the text. Front wheel drive cars, their advantages and disadvantages, are completely covered. The construction of the Ford Model A also receives adequate attention.

The first chapter explains the mechanism of the automobile; the second gives you hints concerning the routine of your car. Subsequent chapters tell how to recondition and drive your car. Engine trouble, in its many phases is described, as are the repairs necessary. Causes for the usual troubles experienced by the car driver in operating his car, be it a Ford or a Rolls, are explained so that even the novice can understand them. Some unusual misbehavings of the engine, carburetor, brakes, car rattles and squeaks are considered. Explanations are given for why a repair should be made in a certain manner, as well as how it should be made.

The book can very easily serve as a First Aid to the auto driver. The author, the Technical Editor of "Motor," has written it so that it will prove of value to those who know nothing of a car, as well as those who desire to know more than they do know. Recommended by us as standard equipment with each car.

In the next edition, we would suggest that Mr. Blanchard use more carefully prepared illustrations; for while these are adequate for telling their story, they do not improve the appearance of the book, which is attractive.

PATENTS, TRADE-MARKS, COPYRIGHTS—LAW AND PRACTICE, by Oscar A. Geier. Fifth Edition, revised. Published by Richards & Geier, 274 Madison Ave., New York, N. Y., 128 pages. A free copy will be mailed to all applying to the publishers.

The book is written in terms the business man can understand, and covers the essential features of our Patent, Trade-Mark and Copyright Laws. The Patent Law section of the book explains who may obtain a patent, what may be pat-

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ented, the importance of specification and claims, patent interferences, reissues, appeals, infringement suits, etc.

The Trade-Mark end of the book covers trade-marks in general, valid trade-marks, invalid trade-marks, unfair competition, state registration, interferences, oppositions, appeals, infringements, etc.

This fifth edition has been completely revised to conform with the law and practice since the fourth edition was issued in August, 1928.

The book also gives a large amount of information about the foreign patents and trade-marks. The index, with which it concludes, affords ready reference to the many important subjects treated in this book.

ELECTRICITY FOR BEGINNERS, by Edward Harper Thomas. Pages xxiv —172. The Norman W. Henley Publishing Co., New York.

This little manual, very attractively printed, gives the elements of electrical engineering. It presents topics so clearly that its perusal can be safely recommended to beginners. Electricity is now in such general use that it seems essential that more should be known about its elements by the general public. In the briefest possible way and with definite clearness of statement this book would lay an excellent foundation for the layman who wishes to form an idea of what this strange thing electricity is doing about us. It is a science of measurement and Mr. Thomas' little book treats it as such. The fact that the author starts his second chapter by giving the unit of an electrical quantity, the coulomb, to the student, as the corner stone of his structure, to the reviewer's mind, indicates a satisfactory start and a clearness of vision. It is surprising how many people who talk fluently about volts, amperes and ohms have not the least idea what a coulomb is and are content to go on using the rate unit of electricity without ever thinking about the primary quantity unit. There are many people who consider themselves adequately informed on this subject, who would be greatly benefited by studying this work with pencil and paper at hand to carry out the calculations. As a definitely elementary treatise we are glad to recommend this book for its illustrations. It has a contents and index.

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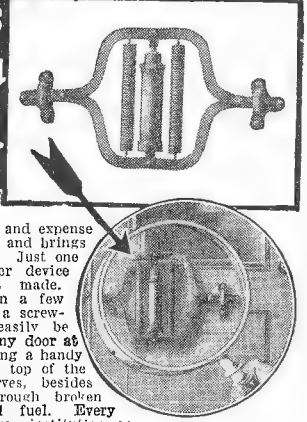

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Answers to Scientific Problems and Puzzles on Page 548

A Waxed Board and a Ball

THE impact of a ball against a board is greater if the ball rebounds than if it sticks to the board. As a ball strikes the board there is a momentary impulse tending to overturn the board. If the ball rebounds there is a second impulse tending to overturn the board. The situation is similar in some ways to a man who jumps upon the end of a spring-board. If he jumps upon the board and stays there after he lands he gives one impulse to the board. But if he jumps upward from the board on the return he will give an additional impulse which will move the board more than in the first case.

A Ball's Impact

THE action in the two cases described is quite different. When two balls, A and B, are drawn aside and released, B strikes first and then A, an instant later. The impulse from B is transmitted through c and d to e. The last ball, e, gets just enough momentum to carry it to d'. The ball d then receives the impulse transmitted to it from the ball A. This impulse would be just sufficient to carry it to position e' if it were not that the ball e were just ahead of it. The result is that d and e get just enough momentum together to carry them to e' d'.

If A and B are replaced by a single ball, AB, of equal weight only one impulse, instead of two, is given to c, d, and e. The ball e, being unretarded by anything in front of it, will get the most momentum and move the farthest. The ball d is retarded by the ball e in front of it and hence gets a smaller portion of the momentum. Ball c gets the least momentum and moves the least. In this case all of the balls move somewhat in the direction of the impulse. In the former case balls d and e get all of the momentum, while e, B and A remain practically stationary after the impact is over.

Where Does the Bullet Come From?

WHEN a bullet passes through a sheet of glass it forms a small hole where it enters and tears out the shattered portion at the larger opening, through which it leaves.

Washing with Alcohol

AFTER washing the precipitate with 100 cc. of alcohol one cc. of alcohol will remain to hold one-hundredth of the original impurity in solution. After the second washing with 100 cc. there will remain only one hundredth of one hundredth or one ten-thousandth of the original impurity.

In the other case we wash three times with 30 cc. each. After the first washing one thirtieth of the impurity would remain. After the second washing one nine-hundredth would remain and after the third washing one twenty-seven-thousandth. Thus the second method is considerably better.

When a Top Spins

THE motion of a top does not actually reverse when the edge of the top strikes the surface upon which it is rolling. It appears to reverse, however, because our attention is now centered on the rolling of the top on its own rim. The situation is then similar to that of a bicycle that is being driven counter-clockwise around the circle. The observer, looking down on the cyclist, sees him leaning inward, the bicycle itself moving counter-clockwise but the wheels going clockwise on their respective axles.

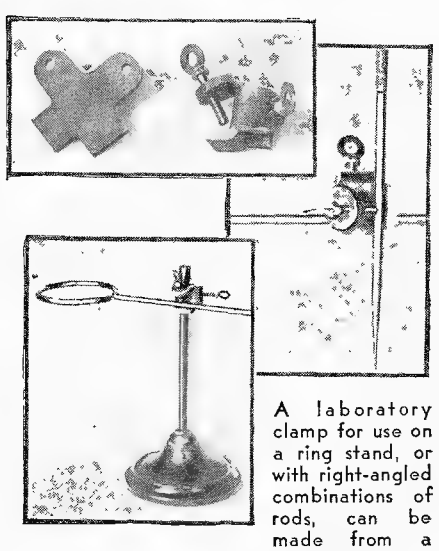
Will a Balloon Rise?

A BALLOON rises because the upward force on the bottom is greater than the downward force on the top. From Archimedes' principle we see that this is equal to the weight of the displaced gas. When the piston descends, the density of the gas increases and hence the weight of the gas displaced is increased. If the balloon itself is not compressed to the same extent as the gas it will displace greater and greater weights of air until finally it is buoyed up to meet the descending piston.

Make This Laboratory Clamp

By Warren N. Crane

A CLAMP made from the simple sheet metal form shown in the illustration, finds many uses in the shop as well as the laboratory. The form is cut out of sheet brass or steel of a thickness to suit its size and the strength required (from 1/16" to ⅛" is most suitable) the holes drilled and tapped, and then the piece is bent to shape by bending the two short legs to a sharp right angle in opposite directions and the long legs through approximately 135 degrees, so that the centre line of the thumb screws pass through the centre of the angle between the short legs and the back. Convenient thumb screws may be easily made by soldering or brazing small washers into the slots in round head machine screws. While the clamp is primarily intended for use on a ring stand, it may be used for any condition where two rods are to be fastened at right angles to each other. In combination with scribers, pencils, etc., and a rod of the required length, an efficient beam compass may be quickly made.



A laboratory clamp for use on a ring stand, or with right-angled combinations of rods, can be made from a simple form.

Electricity—the Home-Maker

(*Continued from page* 507)

switch operated by the closet door are a real asset, especially if the closet is three feet or more in depth—a depth great enough to make light from outside practically useless. There is another point in connection with lighting that may be worth consideration. The present vogue in the living room and some of the other rooms is for wall lights instead of ceiling fixtures. It is conceivable that this may change in later years, reverting to the overhead chandelier of past years. For this reason many houses are being wired for both side lights and overhead outlets but with the latter plastered over and not used, but in readiness for use at a future date if needed.

The main weakness in most lighting systems is the lack of adequate switch convenience. The modern practice is to control all wall and overhead lights in a room by means of a switch located near the door. Or where the room has two doors inter-connected switches are provided, one at each door, so that the lights may be turned on or off from either doorway. This same plan of dual control is extensively used in connection with vestibule and porch lights, lights at stairways and garage lights. This is not just a fad for the convenience of the lazy (aren't we all) although it might have justification in that alone; but in addition it is a worth while safety measure to eliminate the necessity for groping around in the dark looking for the switch, or after switching off the lights, particularly on stairways or in large rooms where furnishings are strewn around.

How Many Outlets?

The subject of the number and location of convenience outlets is one of great importance to the whole family. Here the wiring installation is more likely to go out of date within a few years. Take the average house built five or ten years ago, for instance. It had perhaps three or four convenience outlets in the entire house; one in the living room, one in the dining room, one in the kitchen and perhaps one in one of the bedrooms. To place a floor lamp in the living room meant placing it near the outlet, regardless of whether that was the point where light was needed. Moreover, this one outlet to a large extent determined the location of the furniture in the room.

Today the intelligent planning of convenience outlets demands a plentiful supply in each room. It is by no means too much to have one on each wall of the living room, or perhaps even more in the case of a very large room. One rule which is popular specifies one convenience outlet to each twelve linear feet of wall space. This means that a lamp can be placed anywhere in the room and still be within a cord length of an outlet. Outlets should be of the duplex or triplex, or multiplex variety and as a rule should be placed on or near the baseboard, except where they are to be used in connection with devices high up on the walls, such as electric mantel clocks, or perhaps electric fans, or in the kitchen or laundry where they must readily be accessible and therefore at a convenient height.

Today a home is scarcely modern that does not have an electric flatiron, a vacuum cleaner, a washing machine, a radio, a toaster, a percolator and several table lamps, all operating from the electric lines. In the near future it is probable that sewing machines, refrigerators, ironing machines, dishwashers, hot water heaters, space heaters, exercisers and health lamps will all be in very general use, *plus* any number of other devices which will be much more popular than they are today.

Considering the Future

In view of this condition it would be most short sighted to erect a house today without including in it adequate outlet provisions per room for all this equipment. Even though the owner might feel morally certain that he would never have occasion to use all of this equipment himself, the time will probably come when he or his family will sell the house, at which time the complete provision for electrical convenience will serve as a good selling point. The average cost of the electrical system in building a home represents only between two and three cents out of every dollar spent for material and labor in building as against something like twenty cents of the building dollar for heating and plumbing. Considering that the difference in cost between adequate and inadequate wiring would mean only about the equivalent of one cent added to each building dollar, such an increase in the budget would certainly seem to be more than justified.

In revamping the wiring of an existing home to provide added convenience the owner should seriously consider the advisability of "going the whole hog." Instead of having a little extension work done now to take care of immediate demands and perhaps a few years later be faced with the necessity for further additions, it will often be found more practical and economical to have the wiring installation completely modernized at one time, making ample provision for the future as well as the present.

Among other things it is well to bear in mind that times are changing and that the wiring system of the modern home should include not only provision for lighting and power but also for telephone and radio. Practically every home today has a telephone and a goodly portion of them have radio sets. It is no more logical to have telephone wires running around the picture molding or baseboards than it is to have electric light wiring doing the same thing. Nor should the radio aerial and ground wires be draped across walls, inside and outside. There is no reason why telephone service should be limited to one room, when extensions could readily be installed on the upper floors, thus saving many trips up and down stairs; or why radio reception should be limited to the living room. The modern electric radio receiver has sufficient power to operate several loudspeakers. In many new homes loudspeakers are being installed in all of the important rooms of the house, with radio outlets nearby into which they are to be plugged, these outlets all being permanently wired to a connection at the radio set in the living room.

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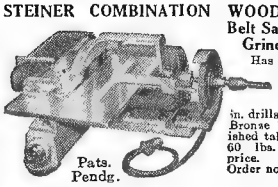

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cal installations it is a good plan for the reader to consider whether he or she is actually getting the full benefit of electricity. The average person knows in a general way that a large number of devices are on the market but relatively few really know the merits of the different appliances, the cost of operating them and other pertinent facts. It is true that some appliances are expensive to operate but for the most part these are limited to the larger cooking devices. In some sections of the country where the electric rates are low even these are not expensive to operate. Some electric companies are offering special rates on "juice" used for cooking. If this practice becomes common it is logical to expect that in the future a good part of the nation's cooking will be done by electricity. In one southern city where a special cooking rate went into effect recently there were something over five thousand electric ranges sold during a single month.

All this gives some idea of the future of the electrical home, and gives more than a hint as to what the builder of today must plan for in providing for the future comfort and convenience of the family.

HOME SERVICE LISTS AVAILABLE

Readers of SCIENCE AND INVENTION who are interested in the Home Service List of Building Material Manufacturers' Literature will find it in the April, May, June or September issue of this magazine. This literature is still available. SCIENCE AND INVENTION has available, also, a list of literature covering the field of electric wiring, utensils, and appliances covering the following fields:

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Fixtures and Outlets
Vacuum Cleaners and Floor Waxers
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Telephone Accessories
Aids to Health
Soldering Irons

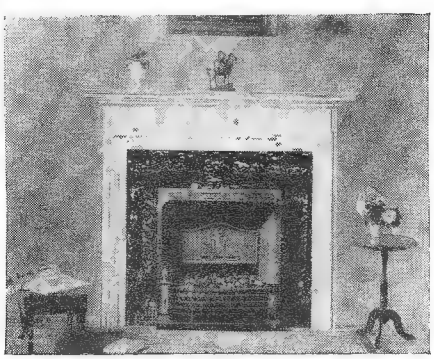
If you are interested in any of these articles, write us, designating which ones, and we shall see that you are supplied with literature on the subject.

The Value of Your Fireplace

(*Continued from page* 505)

wall slopes forward enough to meet the flange of the damper, there will be no question about the quantity of heat coming from your fireplace. The angling side and sloping back walls reflect the heat.

If these eight construction points given above are carefully followed, they invariably make a successful fireplace—one that has good draft control, will not smoke and will give off plenty of heat. If you have a fireplace that already smokes, you can ascertain the cause by checking on these eight points.



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The Mystery of the Ether

By Donald H. Menzel, Ph.D.
Lick Observatory, Mt. Hamilton, Calif.

Further Discussion of the Nature of One of Science's Most Useful Theories, by a Physicist, a Relativist, and a Layman

L.—Is there any direct way of observing the ether?

R.—There are several ways, theoretically, of doing it, but they give rather inconsistent results.

L.—Tell us about them, if you will.

R.—All right. First try to picture a region where hail always falls *vertically.* Then imagine you are on board a ship during a violent hail-storm. Owing to the boat's motion, however, the hail, instead of falling straight down, will descend at an angle. If you stand on deck, you will have to incline your umbrella slightly toward the bow in order to gain complete protection from the storm. As the boat swings around in a circle, your umbrella will successively indicate every point of the compass.

The earth is a sort of ship, sailing through the great sea of ether. The sun and stars rain (or hail) light upon it in a continuous stream, and just as the apparent direction of the hail depended upon the ship's motion, so too is the inclination of the light ray, i.e., the apparent direction of the star affected by the earth's motion. During the year every star in the sky apparently executes a tiny orbit, which is only the reflection of the earth's motion. The effect, called the *aberration of light,* was discovered in 1726 by Bradley.

Now it is important to note that if the air directly above the ship were *dragged* along with it, the hail would have fallen vertically. Similarly, if the *ether* were *dragged* along by the earth, aberration of light would not exist.

Bradley's experiment apparently proves that, if the ether exists, there is no drag induced by the earth's motion. The ether *is quiet in space.*

P.—So far so good—but what about Arago's experiment?

Hailstones and Targets

R.—I'll take that up right now. Obviously the angle at which the hail appears to come down, depends on the ratio of the velocity of its fall to the velocity of the ship. If we were to enter a region of denser atmosphere, where the speed of the hail would be retarded, it would appear to strike at a greater angle.

Now the velocity of light in water is known to be less than that in air. Consequently Arago reasoned that a telescope filled with water would have to be tipped at a greater angle in order to indicate the apparent direction of the star, i.e., the path of the light beam through the instrument. When he carried out the observation, however, he found to his surprise that *the angle of tip was the same as before.*

L.—That seems to be a surprising result.

R.—It was indeed. It appeared as though the ether were *partially carried along by the water,* just compensating for the expected effect.

I must briefly refer again to the Michelson-Morley experiment. In view of its great importance it will not be time wasted. On shipboard we pick up a couple of hailstones. One of them we throw against an electric target astern, so that it rebounds from it and comes back to us. We set up a second target at right angles to the first, taking care to set both of them at precisely the same distance. We are now ready for the test. We throw the hailstones simultaneously and with equal speed at the two targets. The pellet flying to the rear of the boat is helped by the wind arising from the boat's motion and should strike the target before the other stone reaches its destination and rebounds, but it is delayed on the return trip more than it was helped on the outward journey. Consequently one would expect the stone flying abeam to reach the starting point first and win the race. If, however, the result should prove to be a dead heat, one explanation would be that the air had been *completely dragged* along with the vessel and consequently had exerted no retarding effect on either particle.

Amazing Conflict of Opinions

Michelson and Morley performed their experiment in much the same manner on the good ship Earth. Light waves replaced the hailstones, mirrors the elastic targets—and they found, as you know, that the race was indeed a dead heat. If they seized on the above explanation, they would conclude that the *ether* is *completely* dragged along by the earth.

You asked me to find out some additional facts about the ether. Well, here they are:

1. Bradley discovered it to be *at rest.*
2. Arago found it to be *partially dragged* along.
3. Michelson and Morley found that it was *completely dragged.*

L.—But that doesn't make sense.

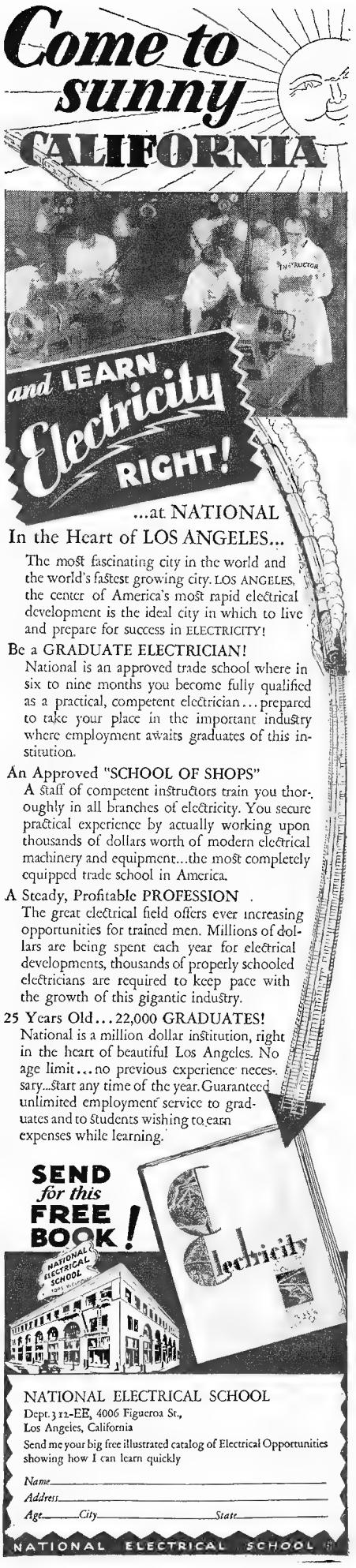
R.—It doesn't make sense in terms of our preconceived notions of how the ether is supposed to behave. But the *experimental facts must stand;* no matter how contradictory they are apparently, we must conform our theory to them, for they are unalterable.

The most successful attempt to account for the difficulty was that of Lorentz. He showed that the electrons in the denser medium, the water, would so interact with the light beam that the ether waves themselves would be carried along, the ether still remaining at rest.

The Michelson-Morley result could be accounted for by postulating a contraction along the line of motion (as if the keel were shorter when the ship was moving). This shortening, called the Lorentz-Fitzgerald contraction, just compensates for the longer time it would ordinarily take for the light beam flying astern to complete its journey. Lorentz further showed that it is in accord with the electronic nature of matter. When electrons flow in a wire, a magnetic field is set up. When electrons "flow through the ether," similar magnetic forces arise and induce the contraction of the moving object.

There is a fundamental difference between the aberration and Michelson-Morley experiments. If the earth had been moving with constant speed in a straight line, all of the stars' positions would be shifted, it is true, but as the shift would be constant in this case and as we have no way of discovering a star's true direction, we could not disentangle the part due to the earth's motion. It is only the continually changing in direction of the earth's motion that enables us to detect the aberration. The velocity involved is that of the earth *relative* to itself at different

(*Continued on page* 562)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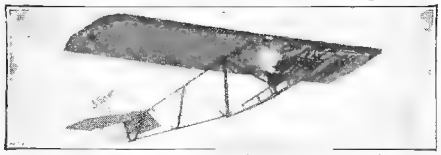

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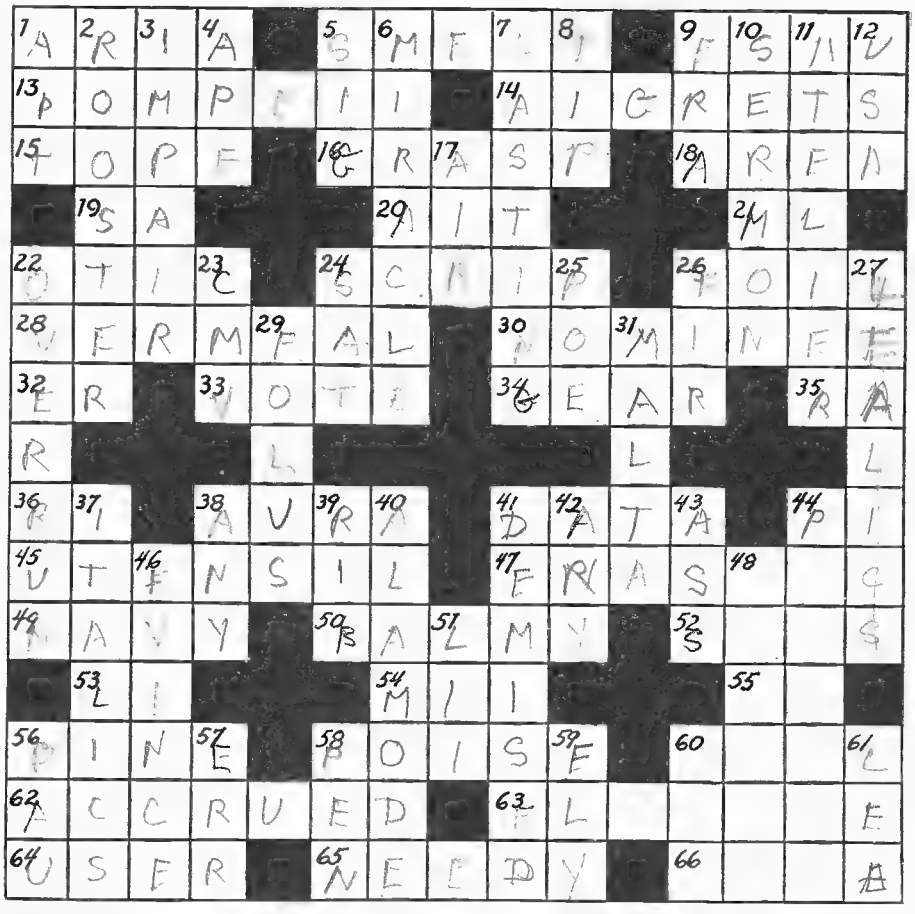
How Much Do You Know?

A Cross-Word Puzzle by Richard H. Tingley, C.E.

"A Little Nonsense Now and Then
Is Relished by the Wisest Men."

ACROSS

1. Air. Not the kind one gets when shown the door and impolitely invited to clear out.
2. A little fish perfectly fresh with a suspicious name.
9. The hairy man of Biblical times whose brother put something over on him.
13. Pliny must have been some sprinter for he beat all records for the speed with which he managed to get away from this doomed Roman city while Vesuvius pelted it with hot stuff.
14. A woman used to be free from regret if she had one of these beautiful bunches of feathers in her hat.
15. Habitually to commune with the cup that cheers and also inebriates.
16. The firm hold you must keep on your "roll" else someone will get it away from you.
18. The passageway where the milkman leaves the bottle every morning for the cat to lick.
33. What the women finally got after years and years of Susan B. Anthony, Mrs. Pankhurst, et al.
34. Toggery.
35. The ancient Egyptian's personification of the Supreme Being though it sounds more like the first part of a college yell.
36. A Japanese mile. A proverb says "After supper run a mile." If it was one of these miles a man would be all tuckered out, for it is nearly two and a half times as long as ours.
38. Animal magnetism; the "bunk" used by clairvoyants to fool people who like to be fooled, oddly enough the word also means a certain kind of vulture.
42. Dope or specifications.
44. The printer might use this in measuring the space to set up this stuff.
45. A tool or implement, whether used by a burglar in cracking a safe or by Ma in feeding the baby.



19. The continent whose people object when the United States is spoken of as being all there is to "America" (abbreviation).
20. A little island in a river or lake. Nobody other than a lexicographer ever heard of it except Dickens who said: "Fog up the river where it flows, among green and meadows."
21. If Cæsar had signed a note at hand for 1050 sesterces he would have expressed the amount this wise.
22. Pertaining to the organ through which one may sometimes hear what people say of him, but not always what they think.
24. A "scrap of paper."
26. This is what the hero in the melodrama does to the villain who pursues the heroine.
28. Back in Milton's time the flappers must have used lip-sticks of vermilion (that's what this word means), at least so he says in "Comus."
30. The man running for public office who goes about making all kinds of promises which he never expects to fulfill.
32. A comparative degree suffix, though it sounds more like the noise made by a man clearing his throat.
47. Something that has been rubbed out, as your name on her eligible list when she finds out you are broke.
49. A kind of chewing tobacco.
50. Poets like to use this adjective to describe the soft, gentle breezes of Springtime.
52. The vegetable that "grows small," "over there."
53. Sounds like a "wrong story," but it means, in China, 0.583 grain over a thousandth part of one of our ounces.
54. One more than the number of tales Scheherezade was obliged nightly to tell the sultan in order that she might keep her head on her shoulders.
55. An abbreviation of the "straight and narrow path" one ought to travel, but doesn't always do so.
56. To languish. Perhaps you think "she" languishes for you when you are far away. Perhaps (?) she does.
58. The state of being well-balanced. A punster has said that no woman can reach this state without a certain amount of avoirdupois.
60. Hard work, such as needed for solving our puzzle, also vexation which may follow your efforts.

62. This is what happened to the interest on the money you owe.
63. A poker player sometimes does this to the "ante." Sometimes he holds 'em; sometimes he doesn't.
64. One who takes advantage of your good-nature.
65. Poverty-stricken. "A hollow-eyed, sharp-looking wretch," as the immortal bard says.
66. One of the various tribes of "Lo's."

DOWN

1. Skilful. People thus endowed are usually successful unless they try to get something for nothing.
2. "Bold Chanticleer" who wakes you up early when you would like to take your "forty morning winks."
3. To deteriorate, as will any man who allows his waist line to become too much inflated.
4. Darwin said he was our ancestor; Bryan said he wasn't.
5. Abbreviation for the scrawl you place at the bottom of your note at the bank.
6. A wonder. It's a "wonder" how some people live who seem to have no visible means of support.
7. The kind of love you declare as "she" fondly reposes her head on your manly breast.
8. A necessary evil no man dares neglect as he leaves his table at the restaurant, or the barber's chair.
9. A period of time of uncertain length.
10. Byron says:
"Let us have wine and women, mirth and laughter,
(These things), and soda-water the day after."
11. In French this means a workshop. With us, a studio.
12. The world's melting pot. An abbreviation.
17. The only "free" thing we know of.
22. What your expenses often do to your income.
23. Nine hundred and five. Pity the poor Romans had to do their arithmetic in these outlandish numerals.
24. To squelch an objectionable person; usually supplemented by the word "on."
25. The American poetic genius, long debarred from his proper place in the Hall of Fame because some fanatics said he was a dissolute character.
26. The tree that used to supply chewing gum before the day of red-light advertising.
27. The kind of man who knows more than the rest of us, or thinks he does.
29. The "Windy" god of Greek mythology.
31. The island from whence comes a certain breed of cats.
37. The style of letters in printing used to give emphasis to something you have written when you have run out of adjectives.
38. The dictionary says "a," "an," "some," "in," etc. Take your choice.
39. Every man except Adam has had twenty-four of these. He had but twenty-three, because he gave one away.
40. In the fashion; also a way to cook beef.
41. Bestowed, bequeathed, transmitted or just gave.
42. The opposite of "nary"; a Yankee colloquialism.
43. Authentic accounts tell us that this animal spoke.
44. A high-hat deeply versed in all manner of learning.
46. To make evident, as you try to make evident to her that she is the only girl you ever loved. Maybe she believes you?
48. A big noise about nothing in particular.
51. Be suspicious of the deck that contains more than this number of cards.
56. A fashionable watering place in the South of France.
57. To do wrong; much easier and often pleasanter than to do right.
58. An implement said to be mightier than the sword.
59. A small English town with a big cathedral.
60. Ten hundred and ninety-five as the old Romans would have it.
61. The sheltered side; we are for it.

See Solution on Page 569

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I smiled and replied that **it would be a pleasure.** Bob's grin changed to amazement. "Don't make a monkey of yourself!" he whispered excitedly.

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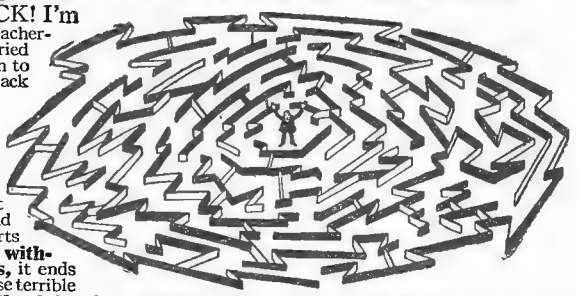

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The Mystery of the Ether

(*Continued from page* 559)

times of the year. Test number three, on the other hand, was an attempt to measure *absolute* rather than *relative* velocity.

While Lorentz's work became the cornerstone of Relativity, Einstein was the first to grasp the true significance of it all. Until then everyone had regarded the velocity of the earth with respect to the ether as something perfectly definite in spite of the fact that we were unable to determine it.

Their conception of Nature bore a vague resemblance to the White Knight's idea:*

* From "Through the Looking Glass."

"But I was thinking of a plan
To dye one's whiskers green,
And always use so large a fan
That they could not be seen."

Einstein thought it possible that absolute motion might have no meaning at all. Therefore he built his famous theory on the basic postulate, *By no experiment whatever can absolute motion be detected.* But I've gone into that before.

L.—Then Relativity owes its birth chiefly to the inconsistencies of the ether hypothesis!

R.—There is an interesting confirmation of Relativity I haven't explained as yet. I'll draw a diagram for you. Here are four mirrors set at the corners of a square. Suppose the north pole is at the center of the square. As before, we'll race two light flashes in opposite directions around the track. In this case, any "Fitzgerald contraction" will have the same effect on both beams since they traverse identical paths. If the earth did not rotate the two beams should return to A at the same moment. But as the earth is turning on its axis in the direction of the arrow, the mirror that was at A at the starting gun will have moved to A' during the progress of the race and the beam that ran counter to the direction of the earth's rotation should win the race. An experiment of this kind was performed (though not at the pole) by Michelson and Gale, with the result expected. Again, if the ether had been dragged along, a null effect would have been found.

L.—What, then, about the ether?

R.—I scarcely know what to say. We have tried to approach it but, like the rainbow, it eludes our grasp. We know that it is not composed of atoms or electrons. Some persons, among them Einstein himself, have said that the ether does not exist.

But doubts have been creeping in of late. What does one mean by existence? For example, does the rainbow exist? There are the raindrops and the sunlight (ether waves?), but the impression of a brilliant color is a mysterious product of our minds.

Does anything exist? When matter was supposed to be made up of tiny billiard ball atoms, there would have been ample reason, I think, to have denied reality to the ether. But the physicists split the atom into nuclei and swarming electrons. Not content with that, they have still more recently dissolved the electrons and protons into a pulsating haze that bears a vague resemblance to the old fashioned ether. When we can't understand the structure of so tangible a thing as that piece of wood, I, for one, do not like to make any dogmatic assertion about the ether. Its only excuse for existence is the one for which it was invented—to transmit the vibrations of light and heat through space. What it is remains a mystery. I have a presentiment that the mystery will never be solved.

FORECAST

By the Official Forecaster

OUR promise of last month in this column—that we aimed to cut loose with the **best contest** ever staged—is pretty well fulfilled, we think, by the announcement on Pages 502-3 of the present issue. . . . Frankly, we don't think you'll be able to match this one either in interest, simplicity, worthwhileness, or awards—there seems something especially fetching about a contest where the prizes are **in kind**, so to speak—where the winner gets as his share the very articles he has named in his solution of the problem set. We hope that everyone who has a workshop or a leaning toward one will take advantage of the opportunity we offer him, in all sincerity, to realize his dream of what his shop should be. For our part, we hope to gather much extremely interesting information, in the process, regarding just what can be done with any of three given amounts of money in equipping a home workshop in an effective way. Exact information, too, including the name of the maker—a matter that too often has been skated over in the past. We think the **names of reputable producers** of tools should be as much a part of our information as the names of the tools themselves.

IN our November issue we are going to summarize—or attempt to summarize—the more striking phases of the data gathered in our **Basement Plan Improvement Contest,** including in the article some of the best features brought forward by the winners of third and fourth prizes. We believe that many home owners or prospective home owners are finding hints applicable to their own plans among the solutions already published.

THE fascinating **metallic junk business** is the subject of an article scheduled for early production in S. and I. There's a billion dollars annually being taken out of the once lowly reclamation of scrap metal. Another feature—a story on the **modern suspension bridge** that strikes us as unusual, especially from the photographic angle. Still another covers an industry that was old when the Romans were young, and is still being carried on in the old area in the old way, as well as in new areas in new ways.

CHEMICAL articles in hand include **experiments with colloids** (an up-to-the-second subject) and **experiments with waterglass** (a subject that never grows old). An interesting **electrochemical** article tells how to **rustproof ferrous articles.** In woodworking we have a **Weatherby** piece on **modernistic bookshelves,** and a process article on **dependable joints** by a fellow who knows his carpentry. . . . **How-to-make-it** items include a **sunlamp,** a **drillpress** from a **bottlecapper,** a **jigsaw** from **pipe fittings, kinks** for the **motorized workshop** (by R. B. Wailes), **castings** (by L. Kay Wright), and others. . . . We aim also to publish the prize-winning pictures submitted by the winners in our workshop contest ended July 15. . . . The shop of the first prize winner is particularly fine, we think.

The Men Who Will Judge Our New Contest

WE have been fortunate in securing the consent of two distinguished men in the tool and equipment field to serve as judges in our Ideal Home Workshop Equipment Contest.

The first is Robert Henry Smith, M.S., Associate Professor of Machine Construction at Massachusetts Institute of Technology. His honorary degree of M.S. is from Rhode Island State College. For forty years he has had charge of the Machine Tool Laboratory in the great educational institution with which he is associated.

Professor Smith is the author of two books, *Advanced Machine Work* and *Principles of Machine Work,* which have been adopted as standard text by industrial and technical schools both in the United States and in foreign countries. He is a pioneer in organizing engineering courses in manufacturing processes and mass production. He has had long and wide experience with shop processes and industrial engineering in shops and factories which are nationally known.

The second of our judges is Alfred S. Kinsey, Professor of Shop Practice at Stevens Institute, Castle Point, Hoboken, N. J., Member of the American Society of Mechanical Engineers, and until recently active in the American Welding Society, the Society for the Promotion of Engineering Education, the American Foundryman's Association, the International Acetylene Association and the Compressed Gas Manufacturers. He has had full charge of the Department of Shop Practice at Stevens Institute since 1908.

Came to City at Ten

Professor Kinsey came from a Morris County, N. J., farm, learning the use of tools in the shop of his father, who served as the local wheelwright, and in a blacksmith shop nearby. At the age of ten he went to the city to live, and since that time has supported himself by his work.

At fifteen he secured an apprenticeship with Stevens Institute, cleaning machines and doing chores generally to earn twenty dollars a month. The faculty became interested in him and helped him in his efforts to gain a technical education.

He completed a four-year night course at Cooper Institute, New York, when twenty years old. At this age he had practical knowledge of the machinist's trade, forging and heat treatment of steel, iron founding, woodworking, and the operation and repair of boilers, motors, pumps, and powerplant machinery.

As assistant to Professor James L. Denton, in charge of experimental engineering at Stevens, he spent fifteen years in machine testing of all kinds in the United States and abroad. Thereafter he became an administration officer of Stevens, in charge of the Department of Buildings and Grounds, the Bureau of Printing, and the Purchasing Department. During the past twenty years he has served as advisory engineer to several large manufacturing concerns, in tool development, covering practically the entire metal working and wood working field, plant organization, and other phases. He has visited for study purposes nearly 300 metal-working plants of importance in New England and the Mid-West, during the past two years, studying oil and emulsion coolants for power tools.

The third member of the judges' committee will be Arthur H. Lynch, Editorial Director of the Science-Radio Publications.

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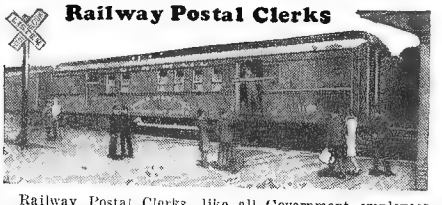
Railway Postal Clerks



Railway Postal Clerks, like all Government employees, have a yearly vacation of 15 working days (about 18 days). On runs, they usually work 3 days and have 3 days off duty or in the same proportion. During this off duty and vacation their pay continues just as though they were working. They travel on a pass when on business and see the country. When they grow old, they are retired with a pension. Early examinations are expected.

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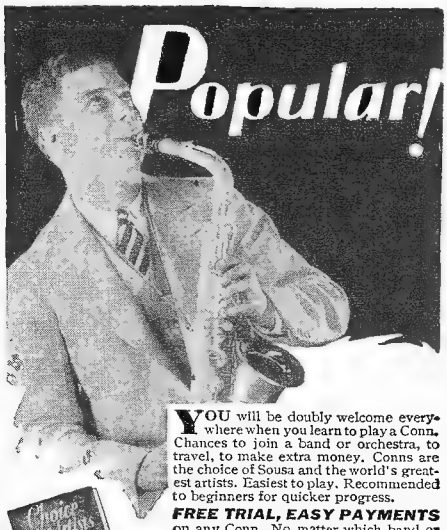

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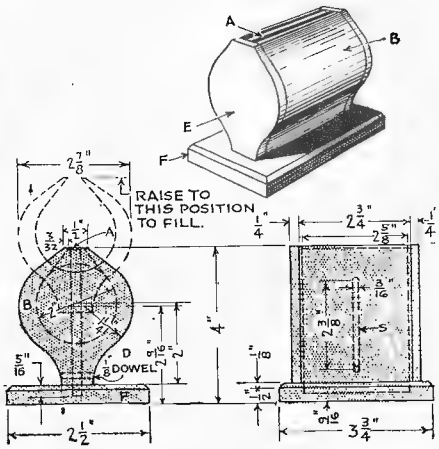
Here's an Automatic Match Box

A BEAUTIFUL, useful and unique match safe may be easily made by following the accompanying drawing and directions. Any kind of wood may be used, either hard wood as oak, maple and birch, or soft wood as mahogany, poplar and white pine. First cut a block of wood 2⅞" wide, 3⅜" thick, and 2¾" long for the body "B."

Make the 2" hole indicated by the dotted circle, with a 2" extension bit or use a smaller bit, or drill a number of holes and gouge the hole to size and shape indicated. A half-inch twist drill with some smaller ones will be excellent. Now cut the outside to the desired shape and saw in half. Plane the two sawed faces to the given dimensions.

Make the base "F," two ends "E" and centre partition "A" according to dimension, making the groove on top edge of the partition to retain the match and a slot in the partition as at "S" to engage the ⅛" dowel "D."



This drawing explains the construction of the automatic matchbox. To operate, raise and lower body B, depositing a match in groove A.

Sand paper all parts. In assembling fasten the end pieces with glue, leaving just enough space between the two halves of the body for the partition to slide freely, without too much play.

Next fasten the partition "A" in mortise in base "F" with glue. Put together and insert the dowel through the slot "S." Carefully sandpaper, stain and polish as desired.

To fill the receptacle, raise the body "B" to position shown by dash and double dotted lines and drop matches through the slot.

To operate the match safe, simply raise body "B" and lower again to original position, thus depositing one match in groove "A."

Glue should suffice, but very thin dowels or brass nails may be used.—*H. R. L. Chellman.*

Keep Mice from Bottom of Desk or Safe

TURN desk or safe bottom side up and tack screen wire all over the bottom and the mice will not be getting into the safe or desk from the bottom and destroying papers or other material that they can chew up, causing waste and much annoyance.—*Horace Le Master.*

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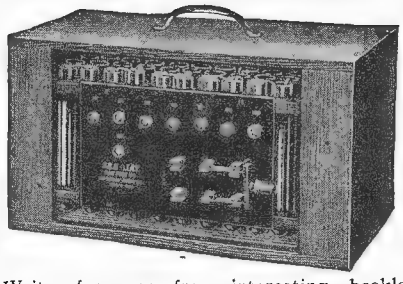

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In RADIO NEWS For October

The Stenode Radiostat makes its initial bow to the American public in an article this month by W. T. Cocking.

Fred H. Schnell gives us more constructional data on the Radio News Short-Wave Superheterodyne.

A Modulated Oscillator for testing completed receivers and furnishing the basis of numerous interesting experiments is the subject of an article by George Fleming of the Technical Staff of RADIO NEWS.

Batteries, what they are and how they should be used, is thoroughly covered by James Martin in his article entitled "Some Facts About 'B' Batteries."

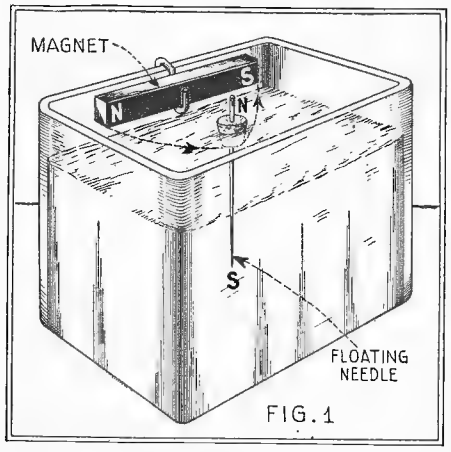
John B. Brennan describes a 50-watt transmitter, built by him, that will delight the heart of the short-wave enthusiast.

Backtalk from the readers of Lieut. Wenstrom's articles is given in an article under this title. Many interesting points of controversy are brought up by readers and answered by Lieut. Wenstrom.

Peculiar Facts about Magnets

FOR the investigation of a magnetic field one usually uses iron filings or the magnetic compass needle. In both cases a picture of the lines of force is given but no presentation of the power of motion or of moving which a magnet exercises.

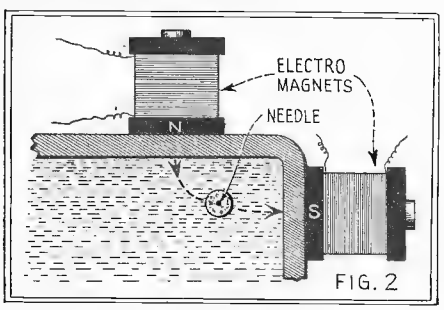
Experiments with a single magnet are far better, but while there is, of course, no such thing as a single magnet pole, it is possible to get the effect of one in a practical way. For this we use a sewing needle magnetized as strongly as possible. On one end of the magnetized needle a bit of cork is impaled and the needle is put into water, so that the north pole projects a little above the level of the water, while the south pole is at quite a distance below it. This gives us a floating north pole with which the following experiments can be carried out.



The above experiment shows the field of a bar magnet as the needle moves along the lines of force.

Experiment 1: *The field of a bar magnet,* Fig. 1. The magnet is fastened to the side of a vessel. The best way is to use a glass jar, because then you can see better. Otherwise it doesn't matter what you use, except an iron vessel will not answer. Now if the floating pole is put in the vessel of water, it moves slowly along the lines of force, whose contour one can easily observe in this manner.

Experiment 2: *The field of an electro-magnet,* Fig. 2. The experiments with small electro-magnets are still better as their action is stronger than that of permanent magnets. It is very interesting to examine the field between the poles in all possible positions. Such a one is shown for two magnets, whose cores are at right angles to each other. Furthermore, one can vary the experiment by reversing the poles of the magnet by simply changing the direction of the current, or we can examine the field existing between two similar poles, but one must take care not to make the electro-magnets too strong, as it might easily happen that the floating needle would be demagnetized.



The field of an electro-magnet can be observed as shown. A floating needle is also used in this experiment.

How to Build a SCOUT Secondary Glider

(*Continued from page 523*)

safety belt should be a very strong strap four inches wide with a buckle easy and quick to open. The belt should not be screwed to the main upright, but go around it and be fastened high enough to reach around the pilot's chest and not his stomach. Another good place to install the safety belt is underneath the seat so that it will strap the pilot's thighs to the seat. The Russell Manufacturing Company, Middletown, Conn., is selling a safety belt especially designed for gliders.

The spruce members of the cockpit right in front of the pilot may be padded; a cushion may also be fastened to the main upright behind the pilot's head. A seat cushion will help a great deal towards happy landings.

Check all the bolt nuts for being locked or secured with a safety pin. Cotter pins must secure the control hinches. Grease all the pulleys. To check the pulleys inside of the wing and fuselage we cut slots in the fabric and provide them with the practical "zipp" shutters.

We do not advise putting instruments in the cockpit. The student flyer should learn to glide by "feel." But after some flying experience is gained a venturi tube airspeed indicator can be installed for the advanced students. The venturi tube is best mounted on top of the cabane.

At last the glider is ready to be snapped into the air. The last expense we have is for the purchase of a shock cord. An aircraft grade shock cord, which consists of many thin rubber strings, is from 5/8 to 7/8 inches thick and from 100 to 150 feet long. It can be purchased from the Russell Manufacturing Company, Middletown, Conn. Keep this shock cord in a cool and clean place and it will last for years.

To get the glider to the glider field quickly and safe we may build a trailer using an old automobile axle and wheels with a light wooden frame. The wings are fastened upright, resting on the leading edge to each side of the frame and the fuselage with the tail-section is put in between.

SCIENCE AND INVENTION is suspending temporarily the page entitled "Let's Laugh." Until further notice, readers are requested not to contribute material for this department.

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Making Big Ones Out of Little Ones

(*Continued from page* 500)

say one-quarter mile, or 1,320 feet. At a scale of one-quarter of an inch to the foot this would equal 27′ 6″ away from the main object, in this case the dam. All drawing on the miniature must follow this scale so our proportions will remain true.

The "set" is to be shot with a 50 mm. lens. This means that our lateral spread must remain within an arc of 28 degrees, or for ordinary purposes the object photographed must not exceed a width of half the distance the camera stands away from the object, in this case 13′ 9″; but as we do not desire a dam of over five hundred feet in width (10′ 5″) both sides of the dam would be filled in with rolling mountains, between which the dam has been constructed. Now our foreground must be filled in. We draw the river bed through which the river flowed prior to the intervention of man. A small stream, the overflow from the dam, is permitted to flow through the valley, perhaps under a bridge of structural iron. A roadway leads from both sides of the bridge and loses itself in the foothills. Trees are freely scattered over the landscape. A small gatehouse on top of the dam emphasizes, by its diminutiveness, the massiveness of the dam.

Wood, Wiring, and a Rubber Pocket!

The background is composed of the water retained by the dam. It spreads in an immense lake to the mountains in the distance. Nothing with any distinct lines is placed on these far away hills. They are too distant for the eye to discern anything distinctly.

Each step has been done with discrimination and exactness of draftsmanship. The plans are now turned over to the craftsmen for construction.

A mold of the dam is constructed. The sections into which it is to break are separated by mounds built in the mold. A central buttress is the place selected for the "break." The adjacent main wall in the divided section is fastened to this buttress with wires allowing enough wire so the buttress seems to collapse before the wall behind it follows. The buttress is made of wood and is in sections. It serves as a trigger to disrupt the wall at the proper time. It is operated by a lever behind the set.

Where the trigger penetrates the floor a flexible rubber pocket is fastened about the opening and the trigger, to prevent the flooding water, when the dam breaks, from flowing through the opening instead of down the river valley.

The mold is filled with a composition of plaster and glue. The glue is used for the purpose of retarding the setting of the plaster. When the casting reaches the proper degree of hardness, it is removed from the mold. The face to the camera is scored in the places where the cracks are first to appear with the attending tricklets of water. These cracks are filled with salt. Two channels lead away from these salt cracks to funnels on each side of the dam (the funnels are out of the picture). A thin coating of glue into which color is mixed is painted over the face of the dam to cover any evidence of the salt cracks. When this is dry the back is heavily coated with shellac.

A table about 2′ 6″ high and of proper size is constructed. The plaster dam is placed in position on this table. Band-sawed ribs of ¾″ wood are tacked from the dam and table to form the mountains and the river valley. Straight ribs form the sides back of the dam; curved ribs complete the background. Over these ribs is fastened a cover of one inch mesh chicken wire, and worked into the undulations of rolling hills. Squares of burlap are soaked in plaster and worked into the wire mesh. The whole is painted in shades of color calculated to further the deception. Trees made of wire and dyed sponges, are planted about the landscape. It must be remembered that we are working one-quarter of an inch to the foot and our trees are very diminutive. Great skill is required in forming the proper leaf formations.

The structural iron bridge is made of cardboard and wood. Great care is required in building properties of this kind as it must be remembered that the camera is microscopic in photographing details. Proper weathering by a skillful scenic artist adds to the bridge's appearance. The workmanship on accessories of this sort depends entirely upon the amount of money the producer wants to spend on the miniature.

The tank back of the dam must be of sufficient size to contain the water needed for the coming flood. It is constructed of wood and lined with tar-paper. It must be waterproof.

A sky-backing of blue or gray (relative shades of both have the same photographic value) composed of canvas stretched on battens, form the firmament and back the set.

The operation of the trigger causing the breakaway is only a matter of a second. In an actual fall of a wall eighty feet high, figuring that a falling object would approach the earth at an approximate speed of sixteen feet per second for the first second, four seconds would elapse before the top of the wall would hit the ground. Mechanically our miniature is four times too fast. It is an impossibility to retard the natural fall and have a real effect so we have to resort to the "speed camera."

Faking an Eighty-Foot Fall

The normal speed of a motion picture camera is ninety feet, or 1440 frames per minute. To obtain the effect of a wall eighty feet high falling in our miniature, we must speed our camera four times normal, or 360 feet—5760 frames per minute. This film projected at a normal speed upon the screen gives the effect desired. It slows all action, giving to movements in the distance an appearance of actuality. The overflow from the dam has the appearance of a river lazily meandering to the sea.

We must not forget the camera man. It is his knowledge of lighting and photography that makes possible the proper shadows and haziness of distance which greatly enhance our finished picture.

The camera in position and fastened down so the vibrations from the rapidly traveling shutter will not jar the camera, and the "inkies" set, the operation is ready to begin. Water is poured into the funnels and through the tubes to the crevices filled with salt. Slowly the salt dissolves. The cracks appear. Water trickles

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30x5.00-20"		2.95	1.35	33x4	2.95	1.15
28x5.25-18"		2.95	1.35	34x4	3.50	1.15
30x5.25-20"		2.95	1.35	32x4½	3.20	1.45
31x5.25-21"		3.20	1.35	33x4½	3.20	1.45
30x5.77-20"		3.20	1.40	34x4½	3.45	1.45
31x6.00-19"		3.20	1.40	30x5	3.60	1.75
32x6.00-20"		3.20	1.40	33x5	3.60	1.75
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from them and then at a signal from the cameraman the lever at the rear of the set is pushed. The dam gives way and the wall of water rushes through the breach and down the river valley.

Two minutes have elapsed since the beginning of our operations, but seven hundred and twenty feet of film have been exposed. Sufficient for our purpose. In all probability only about thirty feet of this film will be shown in the finished picture.

In a sound picture the proper sound effects would be added later. A margin of one-tenth of an inch is reserved on the side of the film for this purpose.

Accompanying this article are photographs of a miniature constructed by the writer for Pathé. It was used in an industrial picture made by Pathé for Westinghouse. It is a replica of a building built in 1893 and now no longer in existence. A movie of the electric fountains (first of their kind) in the lagoon, with the building in the background, was desired for the picture. Since the building is no longer in existence, a miniature was the only solution.

Metals That Grow

(*Continued from page 520*)

the lead acetate, is added. This starts the reaction and it will go forward quite rapidly. Care must be taken not to use too much acid, for this would increase the speed of the reaction to such an extent that long posts and poles will develop rapidly if the metal zinc is suspended from the top of the solution. This is, of course, a mysterious growth to the man unfamiliar with chemistry and is therefore rather effective as a parlor trick. After the lead tree has grown for a few hours, it develops a pendulous formation of crystal-like plates, which branch in all directions. But if the zinc or fragment of zinc is dropped into the solution, nothing more will happen than that the metal seems to swell. It then has no particular form and is almost useless as a show experiment.

The tin tree is quite different in shape from the other metal growths. This tree can be readily developed by dissolving tin chloride in dilute hydrochloric acid or by dissolving tin in hydrochloric acid with heat and diluting the resulting solution. Hang a small strip of zinc in the slightly acid solution of tin. The growth, if the acid is comparatively strong, is very rapid, and the evolution of gas will almost always destroy the growth by causing it to drop away from the zinc. The best results are obtained when the acid is not too strong. Then the growth is normal and fast. Numerous spears and branched rods being developed in profusion give the growth its own peculiar and characteristic shape.

All of these metal growths are thin and fragile and cannot be transported successfully from place to place. The only exception is the tin tree which is stiffer and more homogeneous. The lead, being in flakes, easily breaks off at the slightest vibration, while the silver is too delicate and thin to have any strength. Then, too, the mercury base of the silver will break away from the tree on the slightest tipping of the container.

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How to Make Inexpensive Varnishes

RESINS are usually employed for varnishes although those kinds which are soluble in alcohol and alkalies are also used in the production of resin soaps.

The wearing qualities of a varnish depend entirely upon the hardness of the resin employed and the liquid in which it is dissolved. If a varnish is made up with a volatile thinner alone it will last just as long as an equally thin film of the resin which is exposed to the sun. Oil, when present, will prolong the life of the varnish, and this longer period of life depends entirely upon the oil employed and it loses its effectiveness only after it has resinified to the perishable condition. Common resin, that is, pine tree resin, is the first to perish, this is followed by the softer copal resins, while the harder copals are far more resistant than any of the other types.

For best results, varnishes should only be applied to smooth, clean surfaces, and it should not be put on too thick, as it then becomes wavy, and not too thin, as it then shows no gloss. A cheap floor varnish consists of 1 pint of turpentine in which 1 pound of common resin is dissolved by gentle heat. Then two quarts of boiled linseed oil are added. Another varnish, more durable and just as easy to make, consists of ¾ of a pound of alcohol soluble manila copal, 4 pounds of purified shellac, ¾ of a pound of venetian turpentine (a very thick and syrupy fluid) and 1¼ gallons of alcohol (denatured alcohol can be used).

For Metallic Objects

To make the list of varnishes complete a type suitable for metallic objects giving a fine durable coating, insoluble in almost all liquids and very simple to make, must be mentioned. It can be poured on, used as a dipping bath, or brushed on the object to be coated. It can be used not only for varnishing metals of all kinds, but also for papers and cardboards and clay ornaments.

Transparent celluloid is cut into thin strips or chips and placed in amyl acetate to swell. The amyl acetate is then poured off and the previously prepared solution of ozonized turpentine mixed with an equal quantity of alcohol, is added to the swollen mass of celluloid. The bottle containing this mixture is now vigorously shaken until the celluloid has dissolved.

Other formulæ, giving somewhat similar results, are:

Celluloid	Amyl acetate	Aceton	Ether	Camphor	Alcohol
5	16	16	16		
10	30	30	30	4	
5				5	50
5	25	25			
5	50				

All parts are taken by weight.

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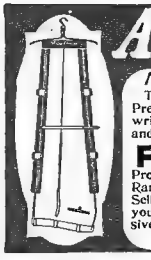

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And Other Stories

Answers and Prize Awards In July Puzzle Contest

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Edward P. McFetridge, 1625 Plumosa Way, San Diego, Cal.

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J. H. Vockeroth, Outlook, Sask., Canada.

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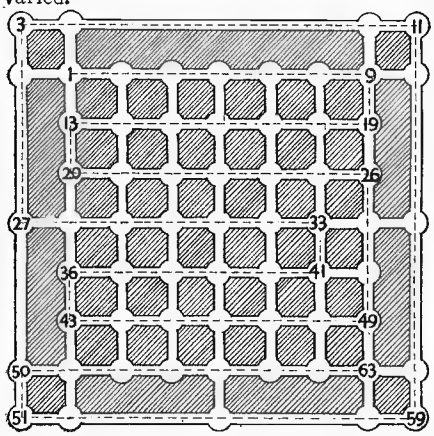
Solution to "A Puzzle from Old Egypt"

The dagram shows how the 63 chambers are traversed in 17 straight moves with 16 turning points. The route may be slightly varied.



Solution to "The Census Man's Puzzle"

When three times as old as Mike, Moe was 22½ and Mike 7½.

When Mike is three times Moe's age at that time, he will be 67½.

When Moe was half that age, he was 33¾.

Mike at that time was 18¾.

Moe is now twice that, or 37½.

Mike, 15 years younger, is 22½.

The problem is solved algebraically as follows:

Let X and 3X equal Mike's and Moe's ages at the time Moe was three times as old as Mike. The constant difference between their ages will be 2X.

Mike will be 9X "when Mike is three times as old as Moe was when Moe was three times as old as Mike."

Moe was 4½X "when Moe was half as old as Mike will be when Mike is. . . ."

At that time Mike was 2X years less than Moe, or 2½X.

Moe is twice as old as Mike was at that time, or 5X, and Moe, 2X years less, is 3X.

Hence, 5X plus 3X equals 60, and X equals 7½ years.

Therefore, Moe is 37½ and Mike is 22½.

A Combination Table

(*Continued from page* 517)

top is shown in Figures 8 and 9. This is framed with a top rail, 21 inches long and 2¾ inches wide, a bottom rail, 21 inches long, 1¾ inches wide, and 2 styles, 12 inches long and 4¾ inches wide each, all of the material being ½ inch thick and mortised and tenoned or lapped together to the dimensions given in Figure 9. The top panel is 22 inches long by 14 inches wide, by ¼ inch thick. If the opening in this top is carefully cut, the part removed may be used for the book rest. The top is glued to the frame, and the book rest is hinged to the top, as shown in Figure 10. The rest is further strengthened with a batten, 8 inches long by 2 inches wide by ¼ inch thick, screwed at the back, and is adjusted by means of a strut 4 inches long by 2 inches wide by ¼ inch thick, which engages a notched rail, 10½ inches long by 2 inches wide by 1/3 inch thick. This is illustrated in Figures 10 and 11. The top upright should be glued and screwed to the frame before the panel top is fixed. It is advisable to raise the sides and back by strips ¾ inches high and ¼ inch thick. The front carries a strip ¼ inch square.

Four rubber or composition casters are fitted to the base so that it will move silently.

Flashes from Radio Lab.

(*Continued from page* 553)

bakelite mounted to the frame. The frame is connected to the rotor plates; the whole condenser was revamped in thirty minutes. There are no plug-in condensers in this shack since this condenser has been placed in use.

LEO BORN,
Topeka, Kansas.

Concrete Loud Speaker

Tests have shown that a concrete exponential horn about eight feet long with a wall six inches thick is the best. In place of a unit, a small paper cone four or five inches in diameter was placed in the end of the horn. Heavy wall board, lined with enameled paper, may be substituted.

Solution to Puzzle on Pages 560 and 561

A	R	I	A	■	S	M	E	L	T	■	E	S	A	U
P	O	M	P	E	I	I	■	A	I	G	R	E	T	S
T	O	P	E	■	G	R	A	S	P	■	A	R	E	A
■	S	A	■	■	■	A	I	T	■	■	■	M	L	■
O	T	I	C	■	S	C	R	I	P	■	F	O	I	L
V	E	R	M	E	I	L	■	N	O	M	I	N	E	E
E	R	■	V	O	T	E	■	G	E	A	R	■	R	A
R	■	■	■	L	■	■	■	■	■	L	■	■	■	R
R	I	■	A	U	R	A	■	D	A	T	A	■	E	N
U	T	E	N	S	I	L	■	E	R	A	S	U	R	E
N	A	V	Y	■	B	A	L	M	Y	■	S	P	U	D
■	L	I	■	■	■	M	I	I	■	■	■	R	D	■
P	I	N	E	■	P	O	I	S	E	■	M	O	I	L
A	C	C	R	U	E	D	■	E	L	E	V	A	T	E
U	S	E	R	■	N	E	E	D	Y	■	C	R	E	E

"Yes—there IS something you can do about it"

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Deadly Germs to Make You Well

(*Continued from page* 501)

the subject he would think he were gazing upon a locker room, such as he would find in a golf club. The incubator is, after all, only a great big room, filled with cabinets arranged in long even rows. Outside the room there is a recording thermometer with a chart on which circular red lines show graphically the temperature at all times. As for the cabinets in the incubator, they contain the flasks that hold the germs and their poisons. There need be no hesitation of walking into an incubator. It is just as safe to look at the flasks as to stare at the stars from an observatory tower.

The Parke-Davis incubator has eighteen large cabinets, each with a capacity of 420 quarts of toxin. In other words, one of those cabinets contains enough diphtheria toxin to kill 800,000 persons! There are other kinds of germs in the incubator, including a great big assortment of tubercle baccili, each of the several thousand bottles of tubercle culture containing no less than 75 trillion tubercle germs. These cultures, which remain in the incubator from three to twelve months, are used to make tuberculin which is employed mostly in diagnosing tuberculosis.

Among the disease germs grown in the incubator are those which cause typhoid, pneumonia, bacillary dysentery, boils, epidemic meningitis, scarlet fever, puerperal fever, erysipelas, whooping cough and diphtheria. In special incubators are grown certain disease germs that are highly resistant to ordinary cleansing agents, such as anthrax, tetanus, blackleg, gas gangrene bacillus and malignant edema.

Encouraging Bacteria

The incubator actually holds about 750 different strains of disease germs, all as carefully catalogued as rare editions in a museum library. The complete life history of every variety is recorded most conscientiously. Every pertinent fact in the lives of these germs, from generation to generation, is noted down for future reference. It has been humorously remarked that only the fingerprints and Bertillon measurements of bacteria are not taken.

Bacteria, it may be surprising to learn, don't just flourish and grow up anywhere like weeds. The cultivation of germs happens to be a very precise science and painstaking art. Indeed, it takes a great deal of knowledge and experience to make germs grow and reproduce in an incubator, and thus produce the toxins that will later be used to make antitoxins.

It is well to view the cultivation of bacteria in an incubator much as we do the development of plants in a greenhouse. The culture medium upon which the germs are grown in the flask can be likened to the soil; in fact, the Germans still use the term *Nahrboden* in describing this material. As a rule, each particular disease-producing microbe has certain media more suited for its cultivation and existence than any other. In other words, no two species of bacteria are alike, either in their physical characteristics, biochemical activities or food requirements.

Those who peer into the lives and habits of germs have learned much about them. Certain organisms, it has been found, prefer more sugar or other carbohydrates; others require certain proteins especially body fluids such as blood or blood serum; while still others are sensitive to the reaction of the media, the growth depending upon an exact titration as to alkalinity or acidity.

All germs, apparently, demand some one or other of the salts before they will do their bit for mankind.

An indication of the varying tastes of microbes can be gotten from the differences in the diets of the diphtheria and tubercle bacilli.

For growing the diphtheria bacillus, a medium found by experience to be most suitable consists approximately of 78 per cent horse serum, 1 per cent protein derivative in the form of peptone, 1 per cent sugar, 0.5 per cent table salt and 15 per cent water.

Trillions of Offspring Daily!

The tubercle bacillus, on the other hand, thrives on 2 per cent vegetable gelatin known as agar agar, 1 per cent peptone, 5 per cent glycerine, 0.5 per cent table salt; all mixed in a medium of beef extract.

A generation among bacteria is from one cell division to another, which usually takes from one-half an hour to one hour, each organism simply dividing into two and thus reproducing itself. Under conditions most suitable for growth, one diphtheria bacillus, with a generation every half hour, would have 143,190,574,851,328 offspring at the end of twenty-four hours; but if the increase is only hourly, then the figure would be 17,289,216, which is probably nearer the normal expectancy.

Many and varied are the conditions upon which the longevity of bacteria depends. Some germs produce certain chemical substances which, in turn, after a certain length of time and after a certain concentration of the chemical substances, have an injurious effect upon the very germs responsible for them. Other bacteria are affected to varying degrees by certain external influences such as heat, cold, dampness and sunlight. Some germs are more or less resistant to these influences; others are extremely sensitive. Under the influence of extreme cold, some germs will practically hibernate for several months or even years. Others will die at once under such conditions, while a few will develop a resting stage which is very resistant to all forms of external injurious agencies. This last type of organism, of which the tetanus bacillus is an example, will survive for years.

Under the most favorable conditions, such as being dried in a diphtheria membrane from the throat of a diphtheria patient, it is a question whether the diphtheria bacillus will live for more than a few weeks; while the tubercle bacillus in dried sputum has been known to live for months.

The whole process of producing life-saving antiserums is an intricate and delicate one. The starting point is the isolation, in pure culture, of a suitable variety of the disease-producing germ. In the case of diphtheria, the organism would be gotten from the throat of a diphtheria patient. The next step is to prepare the toxin. Flasks containing three to four quarts of broth (which is the culture medium) are planted with the culture and incubated at body temperature for from ten days to two weeks. During this time the diphtheria organisms are continually reproducing, and their poisonous toxins are being diffused into the bouillon. At the

end of the incubation period, bacteriologists examine the flasks and apply purity tests, making sure that no organisms other than the diphtheria germs are present.

Next is added a preservative, and the cultures are then filtered. The filtrate now contains the toxic products of the organisms, but no organisms themselves. This is the toxin. In order to produce antitoxin, it is necessary to inject the toxin into horses, or other animals such as goats, so that these animals can be immunized against the poison. The immunizing treatment consists of daily injections of the toxin in increasing doses, starting with a very small amount and gradually increasing it as the tolerance of the horse to the toxin permits. In two or three months, the animal may be completely immunized and can then produce sufficiently active antitoxin.

Wonderful strides have been made in preventing and curing disease since 1894 when the world learned about diphtheria antitoxin for the first time.

Deaths from diphtheria during the past three decades have been reduced by about 75 per cent. Although typhoid fever takes a toll of approximately 6,000 lives a year in the United States, this disease is entirely controllable by vaccination and proper sanitation. Scarlet fever antitoxin and scarlet fever immunized toxin have given the physician all but absolute control over this disease. Even such ills as rabies and lockjaw need no longer be regarded with dread.

There are still some infectious diseases which have resisted all effort to control them. It is the hope of medicine that these germs, too, will some day be tamed in the incubator.

Modern Shelves for the Wall, Table, and Floor

(*Continued from page* 508)

cheapest sort of wood will be satisfactory.

Having decided on and secured enough material to construct the shelf, lay out paper patterns for the sides and back according to the squared off design given. If you lack the machinery to do it with, the curves can easily be sawed with a coping saw. The different parts are assembled with small nails and the shelf is finished as desired.

The shadings of furniture open up a new field of finishing to the amateur. The shelf is darkened around the edges with a deeper shade of the same color that is used in painting it. The procedure is very simple and clearly explained in the illustration that accompanies this article. A small hand spray as furnished by the paint supply houses is the only necessary equipment. This, of course, must throw a very fine mist and some practice in its use will be needed before a professional looking job can be had. The lacquer or enamel must be thinned before spraying. As a final touch of decoration, a transfer design may be applied to the back near the top.

The colors of the transfer pattern may be used as a connecting link between the shelf and surrounding furniture. Or, if a room is decorated in a sombre note, painting the shelf itself a bright, contrasting hue will liven up the tone considerably. If you build a small shelf, you have more chance of using a bright color effectively than with a larger shelf.

An article on wood working by H. L. Weatherby is a monthly feature of SCIENCE AND INVENTION. The Weatherby article for November will concern the construction of book shelves in the Art Moderne manner.

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Can you think of anything more pleasant than a trip to the famous city of movie stars, with all expenses paid—to spend a whole delightful week, have a private car and chauffeur at your command, see the show places of Hollywood, Los Angeles, and ocean beaches—observe a picture in the making, and see the famous stars? This is your opportunity. Send a name at once, be the winner, spend a glorious vacation at our expense. When it's over, return with our check for $1,000 in your pocket. If you are unable to come we will send the $1,000 and give you the cost of the trip in cash. We hope you can come, and make this the greatest event of your life.

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In choosing a name bear in mind this body powder is soothing and pleasant to use after the bath. It gives the body an alluring fragrance that makes you think of the fresh morning breeze from a Hollywood Rose Garden. You may send a coined word such as Odorsweet, Fairytouch, Rosekist, etc., or you may send the name of a flower, tree, bird, or any other name that comes to your mind. For any name may win. Wouldn't it be delightful to win a prize like this? Wouldn't it be a startling surprise to your friends and neighbors to see the announcement of your success published in the local newspaper? Now, don't think you can't win, for your opportunity is just as good as anyone's if you will send in a name. Do it right now; it costs nothing to try, and the very name you send may bring you both prizes if you are prompt. Nothing else to do to win.

Contest Rules This contest is open to everyone except members of this firm, its employees and their relatives.

Each contestant may send only one name. Sending two or more names will cause all names submitted by that person to be thrown out. The prize will be awarded to the one sending the name we choose from among those submitted. Contest closes December 20, 1930. Duplicate prizes will be given in case of ties. To win the promptness prize of a free trip to Hollywood, the winning name suggested must be mailed within three days after our announcement is read.

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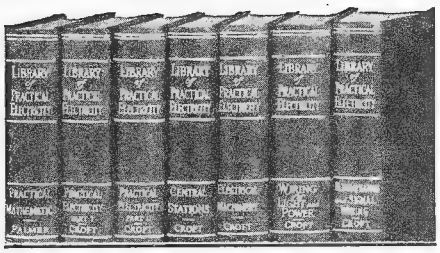

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The Safety Valve

(Continued from page 533)

Thought Waves?

I DON'T claim to be a fortune teller. I am an indifferent poker player. I think your test is what Australians call "a bit over the odds." I don't believe you can force a thought onto a person or into him. But simply this—that it may so happen that a wave of thought passes between two people who are thinking of each other at the same time. For instance, I wrote to a sister living in Port Regal, Jamaica, expressing a wish that I should see her and a brother of mine, who is at present in the Far East, and that we should all meet at home in England in two years' time. I wrote that letter from Buenos Ayres in Argentina last July 26. On arrival here on the first, I received a letter dated July 28, expressing the same wish in almost identical words from her.

Maybe this is a coincidence, but they frequently occur in other people's experiences. Have you ever read any of Camille Flammarion's books; I think "The Unseen" is the title of one which I read, in which he gives a great number of these incidents or coincidences, all of which he vouches for.

I am interested in your point of view from a scientific standpoint. Anyhow, I fail to see why though waves shouldn't operate in the same way as wireless waves in ether, or as one of the factors of everyday life on board ship, namely the Mariner's Compass. This always points to the north, because of the magnetic lines of force of the Earth. Still, you can't see the lines of force or feel them and we have got to take the word of scientists that the lines exist. They know the results they get.

Similarly, if you cross-examine a man about a job or his life or something, you can pretty well read his thoughts before he answers. I think you will agree to that. If so, why not further?

A dog can't speak, yet he can give you a pretty good idea that he wants food; likewise a horse.

I shall have to relinquish my claim for the "mackerel" I'm afraid. Still, possibly my little anecdote may interest you. At any rate, it has the merit of being the truth, even if you only have my word for it.

GEORGE C. W. SITWELL,
M. V. "Brazilian Prince."

(Coincidences such as those about which you write are very frequent. The Patent Office will also disclose countless others where inventors in different parts of the world worked upon the same idea at one and the same time. Such a statement does not preclude the possibility of the formation of thought waves. Science recognizes only those things which it can prove. It is true that we cannot see the magnetic lines of force, but we can prove their presence by other ways and means. It is true also that we cannot see air, nor do we know that air is composed of more than one gas. Nevertheless, we can prove the existence of all of these various gases because of different physical phenomena, and because of the different reactions which these gases give.

A scientist's mind is always open to conviction. If such things as thought waves exist, then they follow certain fast and set rules. The same is true of any other wave phenomenon in Nature.

In our experiments with telepathy, we have offered quite a monetary award for a demonstration of this phenomenon. We are just as anxious to get at the basic causes for such a means of thought transmission as others may be to demonstrate that telepathy can be produced.

Even though this prize has been in force for approximately six years, no one has as yet been able to demonstrate a single authenticated case of telepathy. Even the very first test, extremely simple in itself, has never been produced. This consists of shuffling a deck of cards, choosing any one at random, and holding it up before the eyes of the individual who is to transmit the impression. The receptor, who may be but a few inches away from the individual transmitting the thought, is then to mention the name of the card. It is obvious that but thirteen figures need be transmitted, two colors, or four groups or classes. Any individual capable of transmitting thought should be able to produce such a simple effect. Yet, we must admit that this has never been accomplished before our committee. And don't forget—there is a vast difference between knowing what a man is thinking about and getting a good idea of the subject about which he may be thinking.—EDITOR.)

Seconds Scientific Contests

I AM getting your magazine every month and enjoy it very much. In reading over the last issue I saw you wanted the reader's opinion on J. G. Q.'s proposition of contests. I think he has outlined it very well. It would arouse more readers to take part in the activities of the magazine. The contests should be as general as possible; that is, a topic that would deal with a number of sciences, biology or chemistry (general). If the contest is in one particular science or profession there will be less competition than there would be if it were general.

I hope there are others who will approve of J. G. Q.'s proposition.

CLAYTON KEPPLINGER,
Allentown, Pa.

(J. G. Q. several months ago suggested contests on the subjects of biology, chemistry, physiology, geology, physics, and the like, and suggested laboratory apparatus as prizes. In the case of biology, he suggested giving away a microsope; in the case of chemistry, a complete chemical laboratory. The editor's objections to a contest of this nature were that the contests could not be universally applied. They did not give the amateur chemist or the amateur biologist a break. The contests were primarily designed for authorities in the field, who have little if any use for the prize and whose work in their chosen lines would enable them to win the awards without difficulty because of their ability to handle the situation, whereas others not so gifted, or not so situated, might not stand a chance. These objections have not yet been overruled, so further discussion is in order.—EDITOR.)

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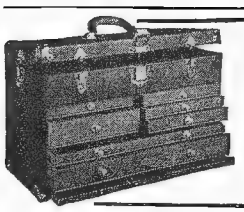

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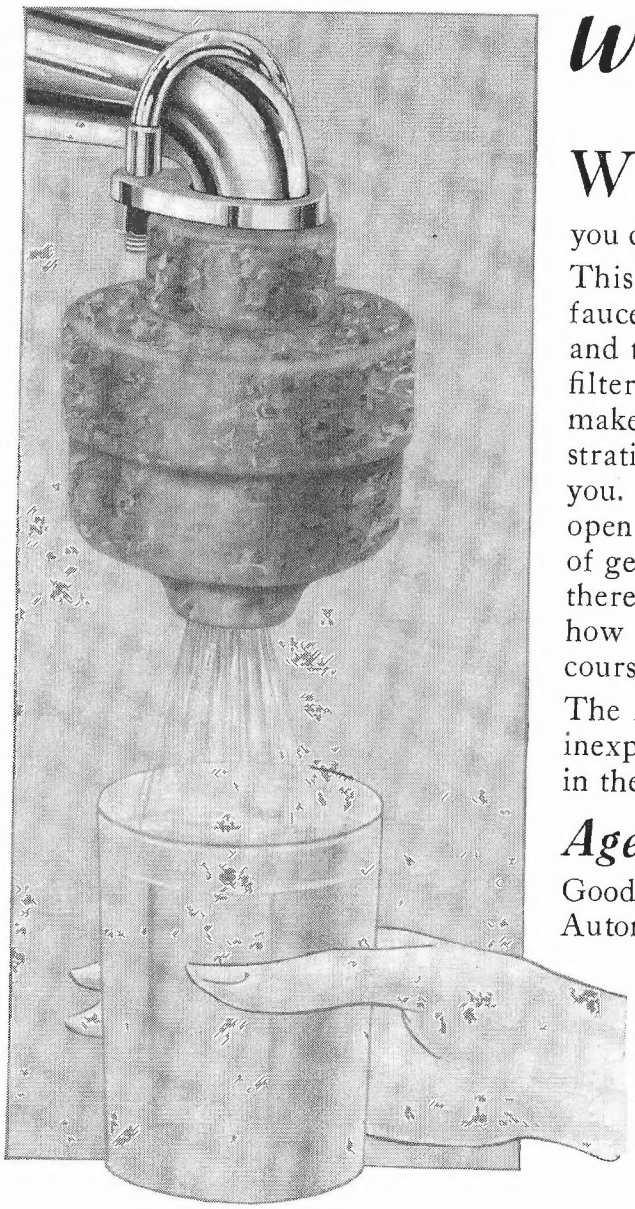

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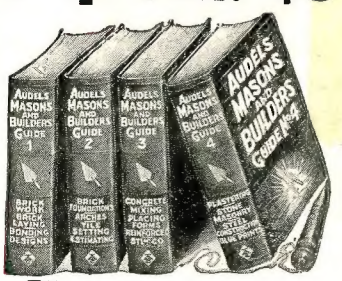

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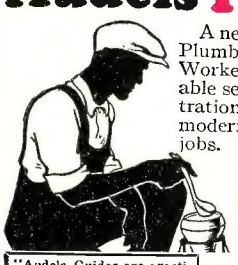

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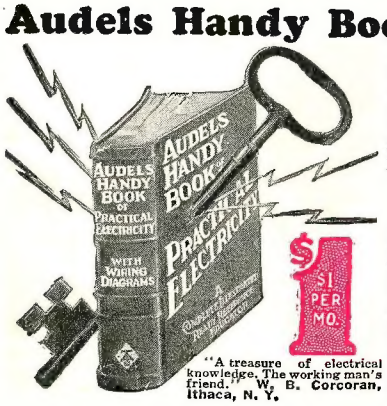

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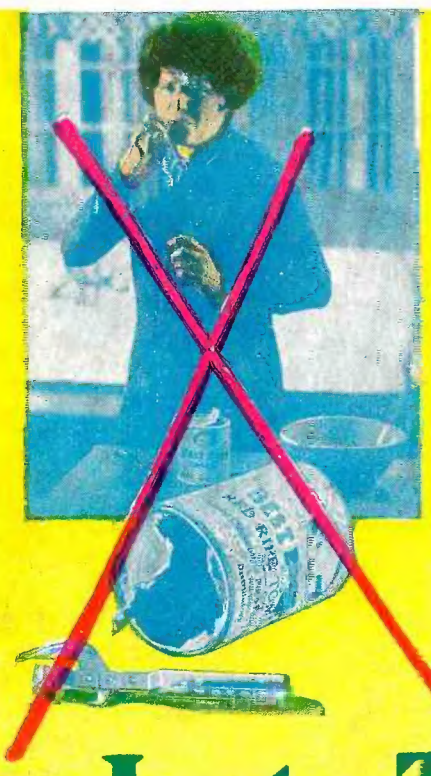

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